SCIENCE.

FRIDAY, JANUARY 11, 1884.

COMMENT AND CRITICISM.

The authorities at Washington show hopeful signs of an interest in the administration of the Naval observatory by proposing the appointment of three eminent astronomers as a board of visitors, who shall annually inspect the establishment, advise with the superintendent respecting the scientific portion of his duties, and report to the secretary of the navy. This measure was recommended by the secretary in his annual report, with the hope that many of the objections now urged against the administration might thus be removed. That he should have expected such a result from this simple measure, leads us to doubt whether the grounds of the objections referred to are fully appreciated, and to suspect that the subject is viewed too much from the stand-point of the politician. The astronomers of the country stand in readiness to give any department of the government any advice which they are assured will be followed, at least in spirit; but they have no taste for the cheap compliment of being consulted for the pleasure of the thing. That fondness of being 'consulted,' that appreciation of the privilege of giving advice, and that love of carrying 'weight' in public affairs, which are so strong in the breast of the politician, are nearly unknown among eminent astronomers. The latter have too many more important affairs on hand to permit of their enjoying the pleasures and duties which fall annually to the boards of visitors of the naval and military academies. They are quite ready to give the government the benefit of their advice, provided they have some assurance that the advice will be acted upon, but not otherwise. Their complaint against the observatory is not that they are not sufficiently consulted, but that the organization of the establishment does not fulfil the condition which common sense shows to be necessary to the efficient administration of a scientific institution.

We have already pointed out what we believe to be the chief administrative wants of the observatory. Briefly summarized, they are, a well-considered plan of operations, to be devised by the highest expert talent of the country, within or without the establishment, and to be obligatory upon the superintendent, and such an organization as shall give reasonable assurance that the plan agreed upon shall be carried out in all the details necessary to its success. For a mere board of advice, it is difficult to see the slightest necessity. The observatory has never been without one or more able astronomers, whose advice the superintendent can command whenever he desires, and who have the great advantage of an intimate acquaintance with the instruments and other means at the disposal of the superintendent. If there is any difficulty in getting and using advice from this source, it is because the situation is such that something else is needed.

Japan may well be proud of the honors that have just been won by two of her sons in two of the best universities in Germany. A gold medal was offered about a year ago, by the University of Leipzig, for the best original work that should be produced within a year, on the embryology of the fresh-water planarians. The subject is a very difficult one, and on this account has hitherto received very little attention. Mr. Isao Iijima, formerly a student in the University of Tokio, under Professor Morse, and subsequently under Mr. Whitman, was one of the few students selected by the Japanese government in 1882 to be sent to German universities. Mr. Iijima began work at Leipzig, in the laboratory of Professor Leuckart, early in the spring of 1882. At the

suggestion of Professor Leuckart, he turned his attention to the subject announced for the prize. From the report of the rector, Professor His, which was read at the last *Rectorwahl*, it appears that the prize has been awarded to Mr. Iijima. The following remarks, taken from the printed report, will certainly be of interest to all who are watching the course of events in Japan: —

"The work receives the highest commendation of the faculty. With regard to its actual contents, it must be pronounced a highly successful work. It is rich in fine observation and thoughtful discussion, and furnishes the best evidence of the ability, knowledge, and insight of the author. It is a permanent gain for zoölogy, inasmuch as it places in clear light the organization and development of a group of animals, which, notwithstanding the importance of its systematic relations, was hitherto very imperfectly understood. *Aperta scidula repertum est nomen auctoris, Isao Iijima.*"

In Berlin another Japanese student, whose name we have not obtained, has recently been appointed, over the heads of able competitors, to the post of assistant in anatomy.

The report of the secretary of the navy for 1883 contains a repetition of his recommendations of last year, that all national work connected with the ocean, carried on by other departments, should be transferred to the navy department, to be supervised and performed by naval officers. Most important among the transfers suggested is that of the coast-survey, which is now under the treasury. This he would have placed under the naval hydrographic office, because there are now sixty-seven naval officers and two hundred and eighty seamen employed in the coast-survey; and he adds, that in view of the facts that no part of the hydrographic work of the coast-survey has the faintest traceable connection with the general purposes of the treasury, that its effectual performance is of vital importance to the navy, and that an office exists to-day in the navy department where similar work is necessarily carried on, it is inconceivable why so inconvenient, artificial, and indefensible an arrangement should be perpetuated.

The secretary ignores the fact that the work which these officers perform is routine, the plans and methods for which have been devised and developed by civilian experts; and he fails to compare the character and quality of the work which the hydrographic office and the coast-survey have performed, and to show that an improvement in the quantity or quality of work would be consequent on the transfer.

Since, then, the present method of employing our superfluous navy, under the intelligent supervision of civilian experts, works no injustice to the navy, and since it is and has been found essential to employ civilian experts to carry on the work of the hydrographic office, we see no benefit which can result from the transfer, except the aggrandizement of the navy; and we doubt if this be a sufficient reason. Should the efforts of Mr. Chandler to absorb all the national work on the ocean prove successful, the fish-commission, like the coast-survey, must be transferred to the navy department.

The red glow in the skies long after sunset and before sunrise has attracted the attention of every one in all parts of the world during the last few months. As showing the hesitation of physicists to attack the matter, it is singular that nothing on the subject had been sent to us until within three weeks, since which time a number of letters, describing the appearance as seen by single observers, have been received. In this number an article is printed in which the facts at the disposal of the signal-service are made use of, and the often-broached Java earthquake theory, which has so many adherents among the best scientific men, is again put forward. The not inconsiderable upheaval in Alaska may also have played its part. It would be interesting to know if the records of earlier times contain any mention of similar red skies following large volcanic eruptions.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Sense of direction.

I HAVE been much interested in the different methods of preserving the relative situation of places, as given in late numbers of *Science*, and will venture to add my own experience.

I refer all objects to two rectangular co-ordinate axes which agree with the cardinal points. In all places where I feel at home, these lines are consciously present, and all roads running north and south, or east and west, coincide with, or seem to be parallel to, these axes. All places which I have visited, from Massachusetts to Nebraska, are, with few exceptions, connected together in one system.

The principal origin of this system is in the northwest corner of a schoolhouse in Hamilton county, O. There, when a boy, I sat under the direction of a teacher to study geography. With face toward the north, I looked through a window along the meridian. I could at pleasure see east or west, or, if need be, south, through opposite windows. A thorough course in geography fixed in my mind the axes of my system, which have been present with me ever since, a secondary origin going with me everywhere. All places with which I am familiar form parts of this system, and any new place visited is immediately referred to its proper location.

Now for the exceptions. There was another schoolhouse, where I attended sometimes, at which I was turned a quarter round. East was north, south was east, etc. I account for the anomaly in this way: in going to the schoolhouse where my system was fixed, I went east, along a road from which I turned to the left into the south or front door of the schoolhouse; but, in going to the second school mentioned, I went through fields into a road along which I passed toward the south some distance, and then turned toward the left into the west or front door of the schoolhouse. I lost the direction of my axes of reference in crossing the fields; so that the west side of the new schoolhouse seemed to coincide with the south of the old, and thus unconsciously my axes were turned a quarter round. No plan I could adopt had the least effect in changing the apparent position of the cardinal points. Many a laugh was raised at my expense because of my promptness in pointing in wrong directions; and to this day, after nearly half a century, if I wish to think of directions from that schoolhouse, I am obliged to change my first decisions through an angle of ninety degrees.

Washington City is another place which is entirely out of my system. I entered the city after nightfall. Somewhere between Baltimore and Washington, I lost my co-ordinate axes, so that, when I came to consider directions, Pennsylvania Avenue was turned half round, east was west, west, east; and I had not and have not the least sense of north or south. No study of maps, and no thinking over the subject, has the least effect in arranging things properly.

Boston is another place which is not in my regular system. In that city and vicinity, Washington Street takes the place of my usual east and west axis, and the street that leads to Mount Auburn is the other axis; but these are not in my mind coincident with my principal axes.

Mistakes made at different times have been quite a study to me. Once, in a city which is regularly laid out, going along the west side of a street toward the south, I crossed the street, and turned toward the north upon the opposite side, and went into an office at my right hand. Coming out, and wishing to continue my course toward the south, I really went north, and spent several minutes before I could convince myself of my error. Possibly the mistake arose in the following manner. I lost my axes in passing from the street-crossing to the sidewalk, and turned north when I supposed I turned south; going into the office toward the right, I seemed to go west; coming from the office, I seemed to be going east; and turning to the right, I was to my mind going south.

It is my custom to travel with a map before me; and, on visiting a city for the first time, I secure a plan and study the direction of the principal streets, obtaining correct knowledge of the points of compass. I then carefully classify my acquisitions, and commonly have no difficulty in finding my way without a guide. MILTON L. COMSTOCK.

Knox college, Galesburg, Ill.

Barn-owls in southern Ohio.

Until recently barn-owls have been of rare or accidental occurrence in this part of the Ohio valley. In the records of the birds in the vicinity of Cincinnati, there were only three specimens noted; and in the record of the birds of Franklin county (Indiana), there has been a vacancy under the head of this species. On Oct. 25, 1883, I was pleased to have a friend bring me a fine male of this species, killed within a half-mile of this town. Soon after this a number of specimens were taken near Cincinnati, at Glendale, where they had taken up their quarters in the town-hall; and others were killed near Jones Station, O. In all, this makes fourteen specimens that I know to have been taken within fifty miles of Cincinnati. A. W. BUTLER.

Brookville society of natural history,
Brookville, Ind.

Phosphates in North Carolina.

The successful exploration last spring, under the direction of our board of agriculture, of the large beds of phosphatic nodules embedded in marl in New Hanover and Pender counties, started the search for phosphates in North Carolina again. Stray coprolites had frequently been found; but these nodules, forming beds four to five feet thick, and extending through the country for twenty miles or more, suggested an origin different from that of the true coprolite.

Phosphatic rock has recently been discovered in the up-country, which corresponds exactly to the water-worn nodules entering into the calcareous conglomerate of the lower Cape Fear.

In the latter region, about Wilmington, and twenty miles above, we find the nodules embedded in, and forming the lowest layer of, a ground and hardened eocene marl. The nodules show the same fossils, but differ from the marl in the large amount of sand they contain. They vary in composition from fifteen to fifty-two per cent of phosphate of lime, neighboring fragments having often very varied composition, of all shapes, but mostly kidney and egg shaped; perforated; color, gray to greenish black; specific gravity, 2.6 to 2.7. Freshly broken or rubbed, they give the odor of burnt powder characteristic of such phosphates.

Higher up the country, in Sampson, Duplin, and Jones counties, we find the eocene marl above, and the phosphatic rock below, in distinctly separate layers. Here the formation is such as to leave little doubt that the rock is phosphatized marl (according to Holmes's theory), and not true coprolites. It is found in large indented slabs, six to eighteen inches thick, and weighing sometimes several tons, or in

smaller pieces, evidently broken from this, and somewhat worn. This rock presents all of the characteristics and all of the grades of the nodules found in the marl conglomerate, — the same shells, same large amount of sand, and the same appearance. The character of the rock changes gradually here. Between Warsaw and Kenansville it is richest, yielding forty to fifty per cent phosphate, while both east and west it grows more sandy. Between Sampson on the west and Jones on the east we find all the grades of rock which were found in a single place in the conglomerate beds of the lower country. We conclude, therefore, that this conglomerate was formed from extensive breaking up and mingling of beds similar to those seen at the present time in Sampson, Duplin, and Jones counties, and not from stray coprolites, as has been supposed.

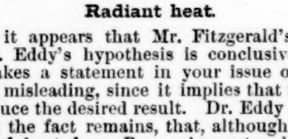
Whether this field will yield any phosphate of more than local value depends upon conditions yet to be determined. CHAS. W. DABNEY, Jun.

N. C. experiment station, Jan. 2.

Radiant heat.

While it appears that Mr. Fitzgerald's criticism upon Dr. Eddy's hypothesis is conclusive, yet the latter makes a statement in your issue of Dec. 21 which is misleading, since it implies that the device will produce the desired result. Dr. Eddy says, —

"Thus the fact remains, that, although a definite amount of heat from *B* remains entangled in the region *m n*, which is not increased with the lapse of time, there is a continued passage of heat through this region into *B*, that being the very object sought to be accomplished by my process."



Now, the fact is, there cannot be 'a continued passage of heat through this region into *B*,' without permitting the passage of heat from *B* to *A*, by any of the processes described. Granting that heat is entrapped in the space *m n*, it will escape into the space *l m* whenever the door *y* is opened for the passage of heat from *A* into the space *m n;* and the heat so entrapped in the space *l m* will pass on to *A* whenever *x* is opened to admit heat from *A*. This is so plain, that it is only necessary to call attention to the fact, to have it admitted. If the only object sought, as stated in the above extract, was to permit the passage of heat from *A* to *B*, it could be secured at once without any device between *A* and *B*. As originally stated, the object was to transfer more heat from *A*, the colder body, to *B*, the hotter one, than was passed in the opposite direction. The writer has shown in another place[1] that Dr. Eddy's system of moving screens fails to accomplish this result. DE VOLSON WOOD.

Limits of tertiary in Alabama.

The announcement in *Science* (ii. 777) of Professor Johnson's extension of the border-line of the tertiary in Alabama to a position ten miles north of Allenton, and six north of Camden, recalls similar observations made by Alexander Winchell in 1853, and published in *Proc. Amer. assoc. adv. sc.* for 1856, pp. 88, 89. These sub-Claiborne beds he designated 'buff sand;' and the overlying ledge of calcareous grit was traced by him "eight and a half miles north of Allenton, which" was "twenty-five miles farther north than the tertiary beds had been hitherto recognized in this part of the state." The undescribed fossils collected were left with Professor Tuomey, who pronounced them eocene, and held them for description till his death in 1857. A few years later the vicissitudes of war involved the destruction of the Tuscaloosa cabinet by fire. Mr. Winchell's observations were communicated orally in December, 1853, to Professor Tuomey, who noted them down on a manuscript map, from which was compiled the map published in 1858 in Tuomey's (posthumous) second report, edited by Mallet. This places the boundary of the eocene a mile north of Allenton, which, as shown above, is not so far north as Winchell traced the formation. There is, however, nothing in the text of the report on which any change in the older map of this region could be based. Professor Tuomey's observations had been directed to other parts of the state; and Mr. Thornton, his assistant, reports tracing this line through Monroe county, while the map shows it located nine or ten miles north of that county, and, if fully conformed to information in Professor Tuomey's possession, would have shown it seventeen and a half miles north. These statements are only important on the principle of *suum cuique.*

A. W.

Italics for scientific names.

The scientific name of every described plant and animal consists of two or more words: namely, that of the genus, used as a substantive; and the specific name, which follows, and is an adjective adjunct. A species may have a dozen or a hundred common or vulgar names, in half as many languages; but there is only one name in the dead, unchanging, scientific nomenclature. It seems to me that the importance of scientific names, over all others, makes them deserving of a more emphatic type than that of the general text. In the ordinary print — as that of this page of *Science* — any scientific name should be given in italics. Take, for example, the American larch, tamarack, or hackmatack. This tree of our swamps may have many local names, but it has only one in science the whole world over. The emphasis of this fact is largely lost if it is written without an underscore, or printed thus, Larix Americana. It would be only a short step farther to have it larix americana.

It does not follow that names of groups need to be italicized. Thus we can have the order Liliaceae, which contains the genus *Lilium* with its Canada lily (*Lilium Canadense*), the golden-banded lily of Japan (*L. auratum*), and *L. candidum*, or the common white lily. *Quercus, Pinus, Prunus, Ranunculus*, and the thousands of other genera of plants and animals, when used alone, may be set in the common type of the page, and stand thus, — quercus, pinus, prunus, and ranunculus; but I do not like it. Many of the generic names are derived from proper names, as Linnaea, Magnolia, Tournefortia, Begonia, etc.; and these certainly should begin with capitals. When, however, the name of any genus is the common name of all the plants in that genus, it is reasonable to use it without a capital, when employed in a general way. We may say of a plant, it is a fine begonia, or a stately magnolia, or a delicate linnaea, and the absence of

[1] *American engineer*, Chicago, 1883, Jan. 12, Feb. 9, 23, and April 6; also *Journ. Frankl. inst.*, May, 1883, 347.

capital letters is well enough, even though the names have been derived from proper names; but, if we say it is a choice specimen of *Begonia Rex*, the case is different. The word 'begonia' now becomes a part of the scientific name of a species of plant. In the same manner the stately magnolia may be *Magnolia glauca* or *M. grandiflora*.

Science does not use emphatic type for the scientific names of genera or species, and doubtless for good reasons. I should like to learn what views the editor and other authorities in scientific nomenclature hold on the above subject. BYRON D. HALSTED.

New York, Dec. 31, 1883.

[We do not agree with our correspondent in his estimate of the value of the scientific names of plants and animals. They are a simple convenience, and have no higher value; and the use of italics for their proper mission — that of emphasis, or as catch-words — is lost if the page bristles with italics having other meaning.]

The skidor in the United States.

In *Science*, No. 44, mention is made, in Nordenskiöld's account of the Greenland inland ice, of the 'skidor,' or Norwegian snow-shoe. It may be interesting to your readers to know that it is the snow-shoe most commonly used in Colorado. It is much preferred to the Canadian or web snow-shoe, and in the mountains in winter is often the only means of getting about from place to place — as from the mines on the mountains to the towns, and from one small mining town to another — when there is not enough travel to keep a road open through the deep snow. I know of one case in which a daily mail is carried twenty-five miles on snow-shoes; two men having the route, each making a single trip in a day, but going in opposite directions. The motion can hardly be called 'running,' as it is in the footnote on p. 737, as the shoes are not lifted from the surface of the snow at all, but slid forward at each step, the foot being raised slightly at the heel as in commencing a step in ordinary walking. The shoes that I have seen are from six to eight feet long, and about four inches wide. A pole about seven feet long is used as a guide and support, especially in sliding down hill, when a tremendous pace is often attained on a long slope. E. R. WARREN.

Colorado Springs, Jan. 1.

Standard thermometers.

In your editorial in this week's *Science* you quote the report of the chief signal-officer of the army, implying that a sensible difference exists between the theoretical standard thermometer adopted by this observatory and that of the International committee of weights and measures, and that the signal-service of the army has adopted a new standard thermometer more nearly agreeing with the latter.

I should be very greatly obliged to the chief signal-officer if he will anticipate the regular course of publication of the scientific work of his office, and give to the scientific public the results, at least, of the work from which it is concluded that the signal-service of the army has reached a nearer approximation to the standard thermometer of the International committee.

I have no doubt that there is a small difference between the standard air thermometer and the particular mercurial standard adopted by this observatory as its practical representative, at points distant from the freezing and boiling points; but, as our own standard has never been compared with any air standard in the possession of the signal-service of the army, I shall be quite interested to see the work by which it is concluded that there exists a sensible difference between the two. LEONARD WALDO.

Dec. 31, 1883.

Romalea microptera.

In 1879, in Alabama, I had many opportunities for observing the habits of the 'lubber grasshopper;' and, if my memory serves me, my observation showed that the hissing referred to by Capt. Shufeldt (*Science*, ii., 813) is due in large part to the forcible expulsion of air from the thoracic spiracles. It was always noticed on the occasions referred to by him, but at no other time. W. T.

Synchronism of geological formations.

I cannot agree with Professor Heilprin in the line of argument adopted in his letter to *Science* of Dec. 21, based, as it mainly is, on the assumed non-occurrence of 'evidence of inversion.' Professor Heilprin asks, "Why has it just so happened that a fauna characteristic of a given period has *invariably* succeeded one which, when the two are in superposition all over the world (so far as we are aware), indicates precedence in creation or origination, and *never* one that can be shown to be of a later birth?"

In reply I would say, that some years previous to Professor Huxley's address on this subject, Barrande, in his 'Système Silurien de la Bohême,' had shown such evidences of inversion to exist in the Silurian formation of Bohemia; and though many geologists and paleontologists disagreed with Barrande at that time, as to his theory of 'colonies' by which to account for the facts, yet none could dispute the facts cited by him. If we now turn to the old red sandstone of Scotland, we find still further evidences of inversion of like kind; for, while the crustacean genus Pterygotus, common to both the upper Silurian and lower old red sandstone, has been recently found also high up in the middle series of this formation, the carboniferous limestone shells, Productus giganteus, P. punctatus, Spirifer lineatus, and others, have been found in the old red sandstone far below the fish genera Pterichthys and Holoptychius, so characteristic of the upper old red division. Though there appears to be no reason why such instances of inversion should not have occurred over and over again, one can readily understand why, through the imperfection of the geological record, and the comparatively small fraction of the earth's surface which has been systematically examined, their occurrence is almost unknown.

With reference to the doctrine of migration, I judge, that, from Professor Heilprin's argument, we look at the matter from two different stand-points. He apparently takes no account of the generally accepted view of biologists, that, while organic development has been closely similar in all parts of the world, the rate at which it proceeded has varied within the widest limits, even in adjacent regions. I cannot help looking on the various formations as the records of that development; and, judging of the past distribution of life on the earth from what we at present see before us, I am forced to believe that identity of organic contents in widely separated strata, instead of being evidence of chronological contemporaneity, is exactly the reverse.

Instead of encroaching further on your valuable space, I would refer to Prof. A. Geikie, who, in the current issue of the Encyclopaedia Britannica (9th

edition, subject geology, part 5), gives exactly that view of the matter which I consider the logical basis on which Professor Huxley rested his argument, and which recent researches have in no way tended to upset. E. NUGENT.

Pottstown, Dec. 27, 1883.

SIR CHARLES WILLIAM SIEMENS.

CARL WILHELM SIEMENS died in London on the 20th of November last, at the age of sixty. This distinguished man, better known to the people of Great Britain and the United States as Charles William Siemens, one of eight sons of Ferdinand Siemens, was born at Lenthe, near Hannover, April 4, 1823. He was one of a family of men of science several of whom have become well known by their success in the invention and introduction of improvements and modification of standard methods of engineering and metallurgical work. Among these, his brother, Ernst Werner Siemens, is the most famous. The two brothers have worked together, with frequent assistance from a younger brother, Friedrich, in nearly every field of applied science. They have been most successful in the departments of metallurgy and electricity.

The elder brother, Ernst, entered the army of Prussia, joining the artillery; and Carl was sent to the University of Göttingen. Carl received his preparatory education at the Gymnasium of Lübeck and in the Art school of Magdeburg, near what was formerly the home of Otto von Guericke. After graduation from the university, he entered the Stolberg engineering-works, in 1842, as an apprentice, but remained only a year, leaving for the purpose of going to London to patent and introduce his first invention, the 'differential governor' for steam-engines, and a method of silvering devised by his brother Ernst. He settled in London, opening an office as civil engineer, and making that city his home, becoming 'naturalized' in 1849, but frequently visiting Germany to meet his brothers, who finally joined him in business.

In 1846 the brothers began the study of methods of economizing in the use of fuel in metallurgical operations demanding high temperatures; and the result of their labors, in course of time, was seen in the invention of the Siemens regenerative furnace, — an invention which has since revolutionized the methods of production of steel and of heating iron, and which is still modifying all the industrial operations dependent upon the attainment of maximum heat in furnaces; such as the manufacture of glass, and the reduction of ores of zinc and other 'useful' metals. In 1849 the brothers William and Werner, as they came to be called, attracted the attention of all who were interested in the applications of science by the announcement of their invention of a method of 'anastatic printing,' modifications of which have now become generally introduced for the production of the simpler kinds of line-engravings. This invention greatly interested Professor Faraday, and he was very soon sufficiently well convinced of its value to volunteer to describe it in a lecture before the Royal institution. His helpful aid was one of the most effective means of making the talented young inventors known and of giving them a start in a career bringing them continually increasing fame.

Siemens next turned his attention to the newly announced dynamical theory of heat, and in 1847 adapted a 'regenerator' to a superheated steam-engine. Modifications of the governor for controlling the motion of clock-work were proposed by him at nearly the same time, and his 'chronometric governor' has been long in use on the instruments of the Greenwich observatory. In 1851 he brought out his water-meter, — an instrument in which was a screw with its recording or indicating mechanism sealed in a chamber having a glass window, through which the readings could be made, and so free from friction that it gave most accurate measures of the flow. The regenerative furnace now began to take such shape that the brothers found it to their interest to devote their attention to that; and in 1856 they worked the invention into such form that they could see in it the promise of complete success. By the year 1861 they had patented some of its most essential features. The inventors succeeded in raising the necessary capital, and erected their furnace in works at Birmingham in 1866, and made steel by their process, which was exhibited at Paris at the international exhibition of the following year. The primary object held in view by the inventors was the manufacture of steel directly from the ore. In this they were less successful than in the making of the steel by mixture of wrought-iron scrap with cast iron on the hearth of their reverberatory furnace. This last-named process has become a well-known method of producing the soft ingot-irons misnamed steels, 'mild' or 'low' steels, which materials are now so exclusively adopted by many makers of steam-boilers and of rails. Such steel is steadily driving puddled iron from the market: it is called, sometimes 'Siemens,' and often 'Siemens-Martin' steel; the first attempts to manufacture steel by this method having been

successful in Great Britain through the efforts of Siemens, and in France by application of the Siemens furnace to this use by Martin. The Landore steel-works, started at Landore, Wales, in 1868, were the first to make steel by the Siemens methods on a considerable scale; and it was there that the great engineer conducted the more successful experiments of later years.

The tastes and the studies of the brothers led them, at an early date, to the examination of the lines of development of applied electricity. In 1848, or earlier, they became interested in telegraph-work, and both Charles and Werner began to apply their inventive talents to the production of telegraph instruments and apparatus of various kinds used in electrical measurements. Ten years later the firm of Siemens & Halske, of Berlin and of London, was formed; and they soon became the most extensive manufacturers of electrical apparatus in Europe. They began the construction of submarine telegraph-cables at an early date, and established, later, factories at Woolwich, England, and in Berlin and St. Petersburg. They finally built up their business to such an extent that it became necessary to have a large steamer constantly and exclusively employed in laying down their cables. The Faraday, named for their early friend, was constructed under the direction of Dr. Siemens, and has been since employed in the laying of the principal long cables under the Atlantic, in the Pacific, and under parts of the Indian Ocean. From this branch of electrical work to that of electric lighting was but a short step for these great men; and they have, during the past half-dozen years, been as well known for their success in the introduction of the Siemens system of lighting, and for inventions of apparatus and machinery in connection with it, as for their earlier inventions in other fields. All successful dynamo-electric machines have the Siemens armature: that method of winding, and its peculiar form, being especially fitted for introduction into the modern forms of dynamo. Their lamp has proved to be one of the best in use; and a multitude of details, worked out with characteristic ingenuity and care, has given their system, as a whole, a completeness, and a degree of perfection in operation, which have contributed in no small degree to the fame of Dr. Siemens. The wonderful combination of scientific knowledge with practical experience and information possessed by Siemens made him eminent in every department of application to which he chose to turn his attention. His success in raising capital for large operations was due to

his personal character, however, quite as much as to his reputation as a scientific man and a talented engineer. The firm of Siemens & Halske was thus able to secure concessions from the Austrian government for probably the most extensive system of elevated electric railways yet projected, and has begun its construction in the city and suburbs of Vienna. The success of such railways at the electrical exhibition was such as to give great confidence that such railway systems will supersede those now in operation by steam.

Physicists will honor Sir William Siemens as the inventor of the 'electric resistance pyrometer,' to which is so closely related Professor Langley's 'bolometer.' They will remember him as the discoverer of the influence of the electric light on vegetation, and as the inventor, also, of the 'bathometer' and the 'attraction meter.'

His papers are numerous, and many of them important: they usually relate to subjects closely connected with his work and his inventions and discoveries.

The greatest commercial and financial successes of Siemens and his partners have been in their telegraph-cable work, and, above all, in the introduction of the Siemens system of generating heat for metallurgical operations. This system is estimated to save, in the steel-works of the country, thirty to fifty per cent of the fuel used by earlier methods, to permit an increase of work done per furnace used in nearly equal proportion, to give a finer product in consequence of the purity of the flame, and many incidental advantages. It has saved to the people of the United States alone between twenty-five and thirty millions of dollars during the comparatively few years that these furnaces have been in general use.

The name of Charles William Siemens is honored in every civilized country; and every nation capable of appreciating the good work done by him has given expression to this appreciation. The British institution of engineers admitted him to membership many years ago, and made him a member of its council. He was awarded the Telford medal for his inventions, a distinction only accorded to the greatest of engineers for the greatest of inventions or constructions, and was given the Royal Albert and the Bessemer medals later. He was made a fellow of the Royal society of Great Britain, a member and a president of the British association for the advancement of science, and a member of the councils of both those societies. He was elected president of the British institution of mechanical engineers and of the Society of telegraph engineers, and was made a member of many foreign societies, both scientific and engineering. He was an honorary member of the American philosophical society and of the American society of mechanical engineers. He was given the degree of D.C.L. by Oxford, and of LL.D. by the universities of Dublin and Glasgow. He received many decorations, one of the latest of which was that just offered him by Austria at the Vienna electrical exhibition. He was knighted, a few months before his death, by Queen Victoria; and his sudden and premature death — for he was a man physically strong and sturdy, and evidently constructed for an octogenarian — did not occur so early as to deprive him of more numerous and greater honors of this formal sort than usually fall to the lot of even the greatest of men.

Sir William Siemens was a man of large, well-shaped frame, muscular rather than fat in his early years, but inclining to stoutness as he grew old. He had a noble, well-shaped head; large, strong, and characteristic features, which were mobile, kindly, and unusually expressive. His manners were those of a man who had grown to know his place in the world and to feel sure of a high place among men, quiet, composed, confident, without being in the slightest degree self-asserting, or at any time disagreeable to his associates, to friends, or to competitors in business. Equally at home in the courts of royalty, in the halls of science, and in the offices of business-men, he impressed every one whom he met with his strength, talents, knowledge, and *savoir faire*. He numbered among his friends the great in every department, — statesmen, men of science, engineers, inventors, and capitalists. He was equally honored and beloved by all, and loved equally well to entertain them all in his fine London mansion and in his beautiful country place, in both of which hospitable homes he met his guests with a plain, simple, and kindly greeting and conversation, which made them at once at home, and at ease with their entertainer. One of his most pleasing powers was that of adapting himself to the temperament and the methods of conversation of those whom he met, whatever their rank in life or their personal interests and lines of thought.

In his death is lost, to his intimates, one of the truest and best of friends; to his employees, a kind benefactor; to science, one of her most splendid workers; to the arts, one of the greatest among their promoters; to the world, one of the noblest among its few great benefactors.

ROBERT H. THURSTON.

THE RED SKIES.

THE remarkable atmospheric phenomenon which has recently attended sunrise and sunset, has attracted great attention not only from the general public, but from scientific men, who have endeavored to give a satisfactory explanation of it. Similar appearances have been noted in former years; but they have been of limited extent, and attributable to local causes. The distinguishing characteristics of the present manifestation are its enormous extent, since it has been observed over nearly the whole earth, its persistence, and the fact that the times of its first appearance have varied in different countries, thus suggesting a progressive motion.

In the United States the reports of observers of the signal-service show that its earliest appearance was in October. At Pensacola, Fla., on the 8th, the phenomenon was observed at both sunrise and sunset. Near the middle of the month it was noted along the southern border from southern California to the Gulf of Mexico. At the close of the month it was observed in great brilliancy in the southern and south-western states. In the more northern portions of the country, during October, the sunsets were characterized by unusual brilliancy; but the peculiar 'afterglow' which marked the later appearances was not noted. In the early part of November the phenomenon was still observed on a few days in the south and west; but after the 20th it appeared in its full beauty over nearly the whole country. In New England, the Atlantic, Gulf, and central states, the lake region, the north-west, and along the Pacific coast, the phenomenon was observed, beginning at various dates after the 21st, according to the weather conditions of the different localities. The 27th was the date in which the appearance was first especially marked in the eastern states. Since that date, to the end of the year 1883, the skies have been characterized by the same brilliancy, whenever the weather conditions have been favorable to its observation; the 27th and 28th of December revealing the appearance in the eastern section of the country to a marked degree.

The sky seems to have had essentially the same characteristics wherever the phenomenon has been observed. In Europe and America, however, if we may judge from the published descriptions, the green or blue appearance of the sky has been less noticeable than in India, where the earliest observations were made. In this country the 'afterglow' has been ruddy, with at times an orange or greenish tint. The observer at Memphis, Tenn., under date of Oct. 30, writes, "For more than one hour after sunset there was in the west a segment of red light, whose intensity and brilliancy appeared equal at all points in the segment. The position (altitude?) of the segment was about 30°, azimuth 45° to 120°." On Oct. 31 the appearance was similar, "except that in the north-east quarter of the segment a few converging bands, apparently dark, entered the segment from a clear sky. While no stars were visible in the illumined part of the segment, they were visible in all other parts of the sky, and also in the bands, which, it appears, were dark in contrast." At Washington, on Dec. 29, a ruddy arch arose in the early morning, and was about 25° high an hour and ten minutes before sunrise. Soon after, the usual twilight arch appeared, also of a ruddy tint; and the two were seen simultaneously, the former losing its outline, and growing paler as it became tranfused over the sky. During the day, the material causing the appearance was plainly visible as a white haze surrounding the sun to a distance of about 30°. At sunset on the 27th and 28th the phenomena were as at sunrise, but in reverse order, the secondary glow lasting an hour and three-quarters after sunset. While the glow at the end of December is perhaps not as intense in color as when first seen a month earlier, it is the same in other respects. It has been described in profuse detail in the daily press; and several English magazines, notably *Nature*, have devoted much space to it.

Three different hypotheses have been advocated to explain the phenomenon, assigning its cause to aqueous vapor, meteoric and volcanic matter respectively. It is undoubtedly atmospheric, and due to the presence of some matter in unusual quantities. The persistence of the phenomenon, and its great extent, are objections to the view that it is due to aqueous vapor. There would certainly have been, ere this, extensive precipitation, were aqueous vapor the cause; but reports indicate nothing abnormal in the rainfall. Moreover, the glow has been most noticeable when the air has been driest: it has been a characteristic of the cold, dry weather, which attends areas of high barometric pressure. In addition, the spectroscope has confirmed the indications of the psychrometer. The pocket-spectroscope shows a very weak rain-band, and a strong development of the bands designated by Piazzi Smyth as a and δ, and ascribed by him to 'dry air,' the

latter known especially as the 'low sun-band.' The same result has been obtained in England and in America. A careful examination of the spectrum with a powerful grating spectroscope, made at sunset on Dec. 28, showed that the aqueous lines were feeble; and the spectrum, at its disappearance, was much farther extended towards the green than is usual in a clear sky. From all these considerations, it seems that the hypothesis of an excess of aqueous vapor in the atmosphere is not tenable.

It seems not unreasonable to suppose that the upper regions of the atmosphere have received from some source an accession of light matter which reflects the sunlight. Of the two suggested sources, — meteoric dust encountered by the earth in its progress, and volcanic matter projected to an enormous height, — either would be a satisfactory explanation. The former would seem in itself the more reasonable, were there not in this instance special considerations which give additional weight to the latter. Both of these hypotheses have been independently suggested by various writers. Mr. Ranyard advocates the meteoric view in *Knowledge* for Dec. 7, and Mr. Lockyer the volcanic theory in the London *Mail* of Dec. 10, and current numbers of *Nature*. English scientific men have shown great interest in this investigation; but few references to it have been made, as yet, in the publications of other countries.

It will be of interest to classify the dates at which the atmospheric phenomenon has been earliest observed in different countries. The following table contains a list of the dates and countries, with the approximate distance and direction of each country from the Straits of Sunda, in which occurred the tremendous volcanic outburst of Aug. 26. It should be noted, that, while the dates given have been collated from the best evidence at hand, there is a possibility that they may be too late in some cases, either from the fact that earlier observations have not been reported, or were not made owing to unfavorable weather: they must therefore be taken as only approximately accurate. A few have been derived from general statements in which the exact dates were not mentioned.

This table has been derived mainly from English periodicals and from the records of the U. S. signal-service. The important references to New Ireland and the Hawaiian Islands were received by letter from Mr. S. E. Bishop of Honolulu, who has also obtained from shipmasters the information that the phenomenon has been extensively seen on the Pacific Ocean since Sept. 1. It is also reported from China, but no date is assigned.

Date.	Country.	Distance and direction from Straits of Sunda.	
1883.		*Miles.*	
Aug. 28	Rodrigues	3,000	S.W.
28	Mauritius	3,500	S.W.
28	Seychelles	3,500	W.
30	Brazil	10,500	W.
Sept. 1	Gold Coast	7,500	W.
1	New Ireland	3,000	E.
2	Venezuela	12,000	W.
2	West Indies	12,000	W.
2	Peru	13,000	W.
5	Hawaiian Islands	7,000	N.E.
8	Southern India	2,000	N.W.
8	Ceylon	2,000	N.W.
15	Southern Australia	3,000	S.E.
15	Tasmania	4,000	S.E.
20	Cape of Good Hope	6,000	S.W.
Oct. 8	Florida	13,000	N.W.
19	California	9,500	N.E.
20	Southern United States	11,000	N.E.
Nov. 9	England	7,500	N.W.
20	Turkey	7,000	N.W.
21	United States	11,000	N.E.
25	Italy	7,000	N.W.
26	France	7,500	N.W.
28	Germany	7,000	N.W.
30	Spain	8,000	N.W.
30	Sweden	7,500	N.W.

An examination of this table shows at once the wide-spread character of the phenomenon, and its progressive motion. It is impossible not to conjecture a connection with the volcanic eruption in the Sunda Straits, by which, on Aug. 26, the island of Krakatoa disappeared wholly from the face of the earth. The terrible nature of this outburst can hardly be realized: the sky was darkened for several days, the noise was heard two thousand miles, magnetic disturbances were noted, the tidal wave was distinctly felt at San Francisco, and the atmospheric disturbance was sufficient to cause marked barometric fluctuations, which were noted by the barographs on the continent, in England and America, for several succeeding days. Coincidence in dates is not a proof of a connection between the atmospheric and the volcanic phenomena; but it is certain that the former were first observed near the scene of the latter, and that similar atmospheric effects have been heretofore recorded over limited areas in connection with volcanic outbursts. Assuming the origin of the atmospheric effects to be the volcanic eruption, the table shows an extremely rapid progression in both an easterly and a westerly direction, — the former over the Pacific Ocean, the latter over the Indian and Atlantic oceans, to South America and the West Indies. Mr. Lockyer considers that the latter continued westward to the Hawaiian Islands, and does not regard an eastward pro-

gression at all; but the later evidence from the Pacific shows that the phenomenon was seen several thousand miles east of Java on Sept. 1. This extremely rapid progression has been mentioned as an objection to the volcanic theory, but it is not impossible to believe in its truth; and we know little or nothing of the motions of the higher strata of the atmosphere. Besides, it is not necessary to reckon from Aug. 26, the date of the volcanic catastrophe; for the volcano had been in eruption since May 20, and the steamship Siam, on Aug. 1, in latitude 6° south, longitude 89° east, sailed for more than forty miles over floating pumice. There seems also to be a well-marked southern progression, though the dates for Australia and Tasmania are probably too late.

It is difficult, however, to trace with certainty a progression northward. The October appearances in the United States, and the November appearances in the United States and Europe, if the result of the August eruption, show a rate of progress very much slower than that in an easterly or westerly direction. There seems also to be a gap in the dates; for, with the exception of the three dates in October, there is a September group covering a large territory, and a similar group in November over a different territory. The October records, which are all in the United States, are definite, but few in number. During this month, and up to the 20th of November, there was a well-marked brilliancy in the sunrise and sunset colors over a large portion of the United States, but it did not possess the marked intensity which seemed to suddenly begin after the 20th. It is possible that the sudden increase in the latter part of November, which was noted both in America and in Europe, was due to the arrival over these countries of the volcanic matter which had been moving slowly northwards for ten weeks; and the October appearances may have been either the sequel of the progression towards the West Indies in September, or the forerunner of the later, more marked appearances.

Another explanation, in consonance with the volcanic hypothesis, may be given. The eruption in the Sunda Straits is not the only volcanic outburst of great intensity which has recently occurred, though it has been better known because occurring in an inhabited region. Meagre accounts have been received of a great outburst in Bering Sea, to which brief allusion was made in *Science*, No. 46. The October weather review of the signal-service contains a letter from Sergeant Applegate, the observer at Unalashka, Alaska, in which he says, referring to some sand which fell in a rain-storm of Oct. 20, —

"This sand is supposed to have come either from the Mukushin, or the new volcano adjacent to Bogoslov. The former is at a distance of about nineteen miles south-west, but for years has only issued forth smoke or steam. The latter is a new one, which made its appearance this summer, and burst out from the bottom of Behring Sea. It has been exceedingly active, as it has already formed an island from eight hundred to twelve hundred feet high. According to the report of Capt. Anderson, the discoverer, who sails one of the company's vessels, and who went within two thousand yards of it, it presents a most magnificent sight. The fire, smoke, and lava are coming out of many crevices, even under the water-line. Large bowlders are shot high in air, which, striking the water, send forth steam and a hissing sound. Bogoslov is about sixty miles from here, in a west direction. The new volcano is about one-eighth of a mile north-west of it."

This makes the position of the volcano, latitude, 54° north; longitude, 168° west. The San Francisco *Chronicle* of Nov. 23 contains a more detailed report, but adds nothing essential to the above description. As this extensive eruption has been taking place for some months, it is not improbable that the atmosphere has received a large accession of volcanic material from this source also; and possibly to this cause may be due, at least in part, the appearance of the sky in November.

It would seem as if an examination of the dust particles brought to the earth by rain or snow would furnish final proof as to the source of the matter causing the phenomenon, provided that it is not wholly above the influence of the descending precipitation. The force of gravity would certainly eventually bring to the earth portions of the material. It is not uncommon for meteoric matter to be found in the analysis of freshly-fallen snow; and an anonymous writer in the *New-York Herald* of Dec. 29 implies that the late snows have given indications of meteoric matter. This, if verified, would tend to confirm the truth of the meteoric theory; but results of quite a different character are announced in *Nature* for Dec. 20, which has been received since this article was begun. An analysis of fresh snow, made by Mr. McPherson in Madrid, Spain, revealed the presence of "crystals of hypersthene, pyroxine, magnetic iron, and volcanic glass, all of which have been found in the analysis lately made at Paris of the volcanic ashes from the eruption of Java." Similarly a microscopic examination of the sediment from a violent rain-storm on Dec. 13 was made at Wageningen, Holland, by Messrs. Beyerinck and Dam, and compared with a sample of ash from Krakatoa.

It was found that "both the sediment and the volcanic ash contained, (1) small, transparent, glassy particles; (2) brownish, half-transparent, somewhat filamentous little staves; and (3) jet black, sharp-edged, small grains resembling augite. The average size of the particles observed in the sediment was of course much smaller than that of the constituents of the ash. These observations fortify us in our supposition, expressed above, that the ashes of Krakatoa have come down in Holland."

These analyses certainly tend to confirm the volcanic hypothesis, though it is interesting to note that some of the substances found by Mr. McPherson are also characteristic of meteoric matter. The evidence thus far accumulated seems to point positively to the truth of the volcanic hypothesis. The opponents of this view dwell upon the improbability of so much matter being thrown up to such a great height, and of its remaining so long a time in the atmosphere. But the magnitude of the Java eruption has certainly not been overrated; and the amount of material thrown into the atmosphere from this source alone is probably sufficient to account for the observed effects. If we add the amount from the Alaskan volcano, there is less reason to doubt the ability of the hypothesis to account for the quantity of material required. The objection on the ground of the persistence of the phenomenon has been met by Messrs. Preece and Crookes on electrical grounds. If the matter thrown up is charged with negative electricity, it would be repelled from the earth, and its particles would repel each other, thus causing the rapid dissemination of the material in the atmosphere, and its retention for an indefinite period. The decline of brilliancy has been slow during the time it has been observed in this country. In the Hawaiian Islands it is still a marked phenomenon, after a lapse of several months. We may therefore expect that for some time to come we shall observe it under favorable weather conditions, but that it will gradually become less prominent until it is known only as a fact of past history.

W. UPTON.

Washington, D.C., Jan. 1, 1884.

WHIRLWINDS, CYCLONES, AND TORNADOES.[1]—VII.

WE are now prepared to consider and explain the actual distribution and motion of cyclones.

The limitation of violent cyclones to the ocean is natural enough: the level surface of the sea allows a great accumulation of warm, moist air before the upsetting begins, and permits the full strength of the winds to reach a very low altitude. On land the air never waits so long as it may at sea, before upsetting; it never becomes so moist; and, when in motion, the inequalities of hill and valley hold back the lower winds by friction. On land the strong part of the cyclone is relatively higher than at sea, as the records of mountain observatories show; and we know less of it.

No violent cyclones are known to have occurred within four hundred miles of the equator. Here, — where the air is warm, quiet, and heavily charged with moisture; where heavy, quiet rains are frequent; where the conditions which have been mentioned as essential for starting a cyclone are of common occurrence, — cyclones are nevertheless unknown. They occur often enough, however, in the embryonic form of thunder-showers, but they never reach the adult stage; and this must be because at the equator the deflective effect of the earth's rotation is zero, and the inrushing winds are allowed to move directly toward the low-pressure centre and fill up the depression, instead of increasing it by their deflection and their centrifugal force. From this we learn, that, while warmth and moisture may be sufficient to begin a cyclone, they alone cannot maintain it. There would be no violent cyclones if the earth stood still.

It might be inferred from this that cyclones should increase in frequency and intensity as we recede from the equator toward the poles, for in the higher latitudes the earth's deflective force is known to increase. It is true that storms are much more frequent in high latitudes than near the equator; and this is very likely due to the greater ease with which moderate indraughts are here deflected so as to produce a central baric depression. But the more intense storms are all within thirty or thirty-five degrees of the equator, because, in more polar latitudes, the air is not warm or moist enough to co-operate effectively with the deflective forces, and produce violent winds. It has already been explained that a rising column of moist air cools more slowly than one of dry air; and on this there was shown to depend much of the greater energy of oceanic storms over that of desert whirls. It should now be added, that, of two ascending currents of saturated air, the warmer will rise much more vigorously than the cooler: hence the warm, saturated air of the tropical sea breeds hurricanes, cyclones, and typhoons of greater strength than the

[1] Continued from No. 45.

storms that are raised in temperate latitudes, although the latter outnumber the former on account of the more effective aid of the earth's rotative deflection at a distance from the equator.

We must next examine the cause that determines the season of cyclones, throws them near the western shores of their oceans, and requires them to move toward or parallel to the eastern coast of the adjoining continents. This will be found to depend on the general circulation of the winds, as may be seen on examining the air-currents of the North Atlantic at the seasons of the most frequent hurricanes. Poey has compiled a list of hurricanes observed in the West Indies since 1493, amounting to three hundred and sixty-five in all; and of these, two hundred and eighty-seven, or nearly eighty per cent, occurred in July, August, September, and October. Now, these are the very months when the equatorial calms or doldrums are farthest north of the equator, and hence in a position to allow the embryonic storms to develop by the aid of the earth's deflective force. At other seasons the trade-winds extend nearer to the equator; and then, in a latitude where storms might grow if once started, the steady blowing trades prevent even the formation of an embryo. The few storms that occur at these other seasons have less evident causes: they may arise in conflicting winds, and may be fairly thrown among those unexplained effects that we call accidental. Once formed, the storm is carried along, by the general circulation and by the strong winds, toward the West Indies. On nearing them, it moves to the north-west and north, mostly because branches of the trade-winds here turn to that direction in the cyclone season, so as to avoid the mountains farther west, and to run up over the warm land of our country; partly because of the continual polar tendency, or excess of deflection on the northern side of the storm. Even if the general surface-winds do not blow along the storm-tracks, it is very probable that the upper current, returning from the equatorial calms toward the prevailing westerly winds of the temperate latitudes, follows a course closely parallel to the average of the cyclone paths; and there is good reason to believe that the upper winds have a great control over the storm's progression. If the storm should begin on the eastern side of the Atlantic, it would probably be held so near the equator by the indraught of the trade-winds that it could not reach a destructive size. The greater Atlantic hurricanes are therefore those that begin in the western part of the calms or doldrums when they are farthest from the equator, and then, passing along their curved paths, take the West Indies and our south-eastern coast on their way up into the North Atlantic. As they go, their diameter greatly increases; because they draw their wind-supply from longer distances, and because in the temperate latitudes the earth's deflective force is greater than it was in the tropics. But with this increase in diameter there comes a diminution of intensity, because the winds are cooler and contain less vapor; and finally the storm dies away when the weakened updraught at the centre fails to throw its overflow outside of the limits of the whirl. The storm is then not working its way: friction will soon cause the winds to cease, and the disturbance will come to an end.

As for the South Atlantic, it possesses no cyclone region, because the doldrums never extend south of the equator. In spite of the sun's passing to the south in winter, the heat-equator, which determines the position of the doldrums, hardly passes the geographic equator in the Atlantic; the excess of land in the northern hemisphere, and the strong general winds of the southern hemisphere, keep it back: and so the South Atlantic has no cyclones such as occur in all the other oceans. The cyclones of the Pacific and Indian oceans depend on conditions such as have been described for the North Atlantic. They are commonest in the southern hemisphere in February for the same reason that they are most frequent in the northern in the months about September.

We have now considered the origin and motions of the cyclones and hurricanes, and the regions of their occurrence. This study has its highest aim in giving timely warning of their approach and in devising rules for avoiding them. If their tracks lay over the land, the telegraph could in all cases give sufficient notice of their coming, for their motion is slow; but they are at sea during much of their life, and the questions now arise, How can the captain of a vessel gain the first intimation of their coming? and, What should he best do to avoid their dangerous centre?

The storm's earliest effect on the atmosphere is shown by the barometer. It is ordinarily stated that the first effect is seen in a diminution of pressure; but it is very probable, both from theory and from careful observation, that a slight abnormal increase of pressure precedes this diminution. The tropical seas, where cyclones are most violent, have, as a rule, very small and very rare irregular changes in at-

mospheric pressure; and careful watching will pretty surely show a rising barometer, as the annulus of high pressure that surrounds the storm (see fig. 8) moves over the observer. The weather may still be clear, and the wind moderate and from its normal quarter; but this change in the glass demands renewed watchfulness. Let us suppose that such an observation be made on board a vessel lying east of the Lesser Antilles. The chart shows the captain that he is in the stormy belt. He may be directly in the path of the advancing storm, where he will feel its full violence; and he must make the best of his way out of it. Following the rising pressure, three other signs of increasing danger may be observed, — first, faint streamers of high cirrus-clouds may be seen, slowly advancing from the south-east to the north-west, or from the east to the west, in the high overflow from the storm's centre; this unpropitious change may accompany the rising of the barometer, or may be first seen when the barometer is highest: second, the barometer begins to fall, slowly at first, but more and more quickly when it reaches and passes twenty-nine inches; the vessel is then within the limits of the storm: third, the wind has shifted so as to blow from a distinctly northern quarter, and its strength goes on increasing; this is the indraught, blowing spirally toward the centre. There is then no longer any question that a storm is approaching; and as soon as a heavy bank of clouds makes itself seen, moving southward across the eastern horizon, then the central part of the storm is in sight. These clouds are the condensed vapor in the rising central spirals, and rain is falling from them. In deciding on a course to be pursued, the first point to be determined is, where is the storm's centre? That being known, its probable path can be laid down with considerable certainty in this part of the ocean; and then, perhaps, the greatest danger may be avoided. But here a very practical difficulty arises. To find the direction of the storm-centre, we must know the incurving angle of the wind's spiral, — the angle of inward inclination that it makes with a circle whose centre is at the storm's centre. The earlier students of the question — Dove, Redfield, Reid, and Piddington — considered the course of wind to be concentric circles, or inward spirals of very gradual pitch; so that they said the inclination of the wind is practically zero, and a line at right angles to its course must be a radius leading to the centre. Later studies showed this to be incorrect. The inclination of the wind inward from the circle's tangent was found to vary from 20° to 40° or 50°: but it was thought that this inclination was symmetrical on all sides; so that, with an average inclination of 30°, the storm's centre must always bear 60° to the left of the wind's course. Finally, the most recent results seem to show that the wind's course is neither circular nor symmetrically spiral; that the wind's inclination is very distinctly different in different latitudes, on different sides of the storm, in the different conditions found on sea and land, at different distances from the centre and at different altitudes. In so complicated a case, much judgment will be required to find where the storm-centre lies.

First, in regard to the latitude of a storm. Without considering its progression, the nearer it is to the equator, the less its indraught winds will be deflected to the right by the earth's rotation, — the more nearly radial they will be. But, as they move with much energy, they will gain in rotary motion rapidly as they approach the centre, and there will whirl around in almost perfect circles. Storms in low latitudes will therefore tend to have a comparatively small but violent central whirl, only one or two hundred miles in diameter, within which the winds may be almost circular; and the centre will there be nearly at right angles to the wind's course. Farther from the centre, the winds would be nearly radial; and, if storms could arise on the equator, they would have simply radial indraughts with a very small central whirl. On the other hand, in the temperate zone the inflowing winds will be strongly deflected to the right of their intended path; and they must depart widely from a direct line to the centre of low pressure, forming a whirl often one thousand miles in diameter: but, unless they inclined inward at a distinct angle, it would take them too long to reach the centre, and their strength would be lost in overcoming friction on the way. Their average inclination is therefore well marked. The steeper inclination of the winds close to the centre, observed in some northern storms (Toynbee), may be an effect of the tornado action in the cyclone, yet to be described.

Second, in regard to the sides of the storm, as affected by its progression. The inclination will generally be less than the average in front and on the right, and greater in the rear and on the left of the centre; for in whatever manner the storm advances, either by bodily transference or by successive transplanting, the motion of the wind must partake both of the direction of whirling and direction of progress, when seen by an observer not moving in either of these directions. In the case of bodily trans-

ferrence, the direction of the wind as shown by a vane will be the simple resultant of its whirling and progressive motions: in the case of successive transplanting, it will be the resultant of the earth's deflecting force and a curve of pursuit; a curve of pursuit being the path followed by a body moving towards a point that is continually changing its position. In either

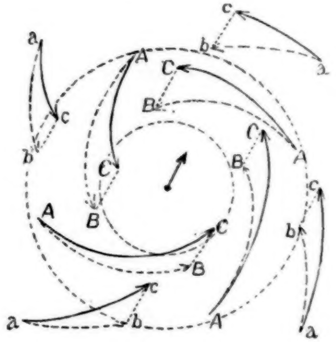


Fig. 18.

case, the effect may be sufficiently represented by fig. 18, in which the broken arrows show the motion of the wind with respect to the storm-centre, and the straight dotted lines measure the velocity of the storm's advance. The wind will seem to blow along the resultant of these two directions, as shown by the full arrows; and the resulting inclinations are

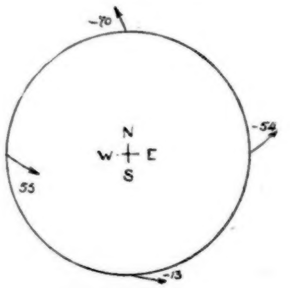


Fig. 19.

manifestly less in front than in the rear, and less on the right than on the left. With the variation of inclination, there will be an inverse change in the wind's velocity. It will blow faster on the right and rear or dangerous side of the storm, and slower on the left and front or manageable side. In the North Atlantic, where the storms often move rapidly, while a hurricane prevails south of the centre, very moderate winds may blow on the north; the difference between the two being about twice the storm's progressive motion. The change in inclination has been shown to occur in some of the West-Indian hurricanes, but it is not very pronounced in the land-storms of the temperate zone. Its best application is in storms on mountain summits; as on Mount Washington (fig. 19), and again in the case of the outflowing winds in the upper half of the storm, as shown by the motion of cirrus-clouds, and illustrated in fig. 20. Of course, in this case of outward motion, the less inclination is in the rear, and the greater in the front.

Third, in regard to land and sea storms. The inclination will be greater in the former than in the latter. On the sea, the centrifugal force of the earth's deflection will be most pronounced, and the winds will be more nearly circular than on land, where friction will tend

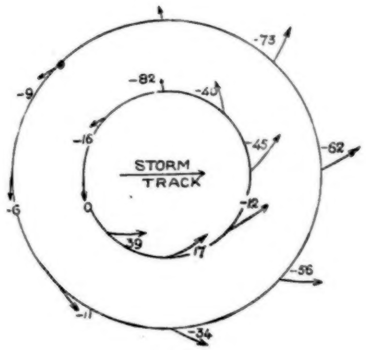


Fig. 20.

to destroy their original motion, and so allow them to run more directly into the storm-centre. This is fully borne out by observation, and is especially well shown in the contrasted cases of storms on the opposite sides of the northern Atlantic. Fig. 21 shows an average storm in the eastern United States, about ready to embark on the ocean; and in this the inclination of the winds is less on the sea than on the land side. This effect is doubtless produced in part by the preceding condition concerning the front and rear sides of the storm. But in examining a storm just about landing on the western shores of Europe, as shown in fig. 22, it is seen that here the front winds have the greater, not the lesser, inclination: hence position in regard to the centre cannot be the cause of the differing inclinations here. A better explanation is found in the fact that the eastern

side of the storm receives its winds from the land, and the western side from the sea; and, in accordance with this, the eastern side should have the greater, and the western side the lesser inclination, as is the case. The fact that European storms have a less velocity of progression than those in this country would still further allow the land and sea conditions to control the inclination in the former region.

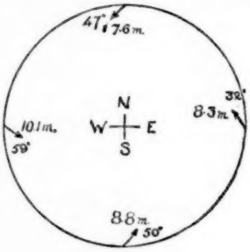


FIG. 21.

Fourth, it is manifest from all the preceding cases that the outermost winds of a storm are nearly radial, and that their direction becomes more circular as they advance. This results directly from the faster motion and less radius, consequently the greater centrifugal force near the centre, and requires no special illustration. It need only be noted, in recalling the first or latitude condition, that, at large distances from the centre, equatorial storms are generally more radial than those of the temperate zones; but, at small distances from the centre, this rule may have to be reversed. This is quite in accordance with the greater size but less intensity of the storms in the temperate zone.

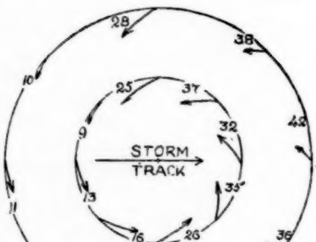


FIG. 22.

Fifth, in regard to altitude. The absence of strong friction will allow the upper winds to whirl in even more circular paths than they do at sea. Indeed, at a moderate altitude, say 7,000 feet, the winds are probably perfectly circular in the core of the storm; and at a little greater height they assume an outward inclination as they change to the outward spiral of the upper overflow. It is common, therefore, to note that the surface-winds of a storm are not parallel to the motion of the clouds. As the latter are more fully in control of the earth's deflecting force, they will always tend to the right of the former; and, in the extreme contrast of surface-indraught and uppermost outflow, the cirrus-clouds may drift slowly (in appearance) 90° or 120° to the right of the surface-winds. It is therefore usually to storm-disturbances of the general atmospheric circulation that the irregular drifting of different cloud-layers is to be ascribed. And now, after this long digression, we may return to the rescue of the vessel in the West-Indian hurricane.

(To be continued.)

THE BUSINESS OF THE NATURALIST.[1]

THE Society of naturalists of the eastern United States is an association in which all preliminaries should be brief, and ceremonious speeches out of place. Our first official meeting at Springfield was, however, almost wholly occupied with the technicalities of organization, and we necessarily gave but little time to other matters. The attendance at that meeting, on account of the natural aversion of scientific men to details of such an uninteresting nature, was small, compared with the numbers now present; and our list of members is also more than double what it was then. Under these circumstances a few preliminary words of explanation will not be wholly without usefulness. Our correspondence with scientific men also shows that the novelty of the organization and objects of this society requires some explanation in a comprehensive and condensed form from some one person.

So far as I am aware, this is the first attempt to form an association for the transaction of what may be called, without derogation to the dignity of our future labors, the business of naturalists.

Heretofore scientific associations have been founded and conducted upon the idea that the technical interests of science were necessarily inseparable from the results of scientific work, and should be considered by the same body which also attends to the presentation, discussion, and publication of the records of discovery and research. It has seemed to me for at least seven years past, that, on the contrary, a division of labor was necessary, and ought to be brought about. The technicalities of science have increased to an enormous extent within the last decade; and some effectual means of mutual culture and

[1] Address delivered in New York before the Society of naturalists of the eastern United States, Dec. 28, by the president, Professor Alpheus Hyatt of Cambridge.

co-operation should be found which can be of great benefit, not only to those whose opportunities have been small, but also not less to those who are capable of contributing most in such a scheme for the general good of science-workers. The contact of fellow-workers not only stimulates the intellect to its best efforts in the presence of appreciative hearers, but enables the mind to broaden its outlook, and avoid the effects of the cloister-like seclusion in abstraction, which has had such fascination for the students of all ages, and which has also had such serious effects upon the usefulness of individual life. The misconceptions and difficulties which science has to contend with have also become of greater importance; and one has only to mention the word 'vivisection' to justify this remark, and at the same time indicate a field for practical effort on the part of this society, which should bear good fruit in the immediate future. In fact, whichever way we turn, whether to the purely practical details of making sections, or other preparations in any branch of natural science, or to the broader questions of a technical nature which interest the public at large, we find in every direction paths of usefulness opening, which must lead to beneficial results for the future of science and science-workers, if properly and judiciously handled.

They seem to us to embody questions which are vital to the unimpeded progress of science. We can, it is true, get along without any efforts to ameliorate the present condition of affairs; but will this be the most desirable course for the interests of science and for our own future satisfaction? Will the amount of time we may gain for investigation by remaining at home, and standing aloof from disturbing causes, repay us for the inevitable loss of influence, and the possible loss of future facilities for the prosecution of work? In some classes of work such losses are sure to be visited upon us, or our immediate successors, through the growth of ignorant prejudices we have taken no trouble to correct or prevent.

An able writer in *Science* of Oct. 26, on the subject of vivisection, points out the necessity of taking some immediate steps for the information of the public upon this question, and, it seems to us, uses very able arguments to support the conclusion, which is, that "the only danger lies in the ignorance of the great majority of ordinarily well-informed people regarding such subjects." This writer, in conclusion, remarks with great force, "*Secrecy*, not publicity, is what American physiology has to fear."

The society may disagree with me, and perhaps consider it unnecessary to take any active steps in this direction; but the unavoidable effects of the general discussion of such a question will be very reassuring to the men who will have to bear the brunt of the coming struggle; and every one who takes part in it will find that his opinions and future course may be more or less influenced, and perhaps even determined, by what he may hear.

Those most deeply interested in the American association will surely be willing to grant that such questions can be more effectively handled in a society composed of purely professional men, whose undivided attention can be given to them, whose interest is of the deepest nature, and who can be depended upon to give sufficient time and work when appointed on committees.

Another question which seems to me of absorbing general interest relates to a matter about which great differences of opinion may exist, even among scientific men themselves; and in this I speak purely as an advocate of one side. What can we do to call the attention of the institutions of learning to the fact that their duties to science and the future of investigation demand a change of policy? Throughout the country, and even in the higher institutions, false views are prevalent with regard to the qualifications necessary for teaching science. We find science-teaching placed on the same basis as mathematics and the languages, in which books are the necessary media for the communication of ideas. It is commonly supposed that a man can learn his lesson, and repeat it to scholars, and that one may be a good teacher of a science of observation without being himself an observer. In some places even, a tendency towards investigation is considered a disqualification, since it withdraws the mind from giving full attention to the practical duties of the classroom. In such places education is measured by the quantity, and rule of thumb, by the amount of supposed knowledge gained, without relation to how it is gained, or what habits of mind are cultivated in the operation. Undoubtedly, the teacher in such places may need and acquire a certain amount of dexterity and success as a mental taxidermist; but that he will ever intentionally train a single student to do original work is beyond belief.

The slight amount of respect and consideration shown to the claims of the investigator are in part due to this evil, and in part to a custom which is excessively hard to deal with. We refer to the habit, very prevalent in this country, of sending children to the same colleges at which the parents themselves have been graduated. This habit shows some signs of breaking up, and the technical schools are doing fine work in this direction; still, the American mind is conservative in respect to education, and tends to keep the hereditary colleges full, irrespective of their intrinsic worth. If these institutions should have to rely solely upon their educational attractions, we should find that the individuality of instructors, their reputation for sound learning and original thought, and their capacity to do the highest kind of teaching, would eventually command the same respect, and perhaps the same emoluments, as in Germany.

Can we, as a body, arrive at any general agreement of what should be done with regard to such vital questions? or can we even do any thing towards the formation of an opinion of what it would be desirable to do? This last result will seem tame to many energetic minds; but the speaker is old enough to have seen the mighty effects of active and determined agitation upon what is familiarly known as public sentiment. Sooner or later — and generally much sooner than any but the most sanguine agitator can anticipate — the times become ripened, and the last

steps of the process of change to the new order of things follow in rapid succession. An event may be long in preparation, but its consummation takes place with a rapidity which must be experienced to be fully appreciated.

Another question of the greatest and at present time-absorbing interest is, what can be done to force the schools to properly prepare students for the colleges and universities? We use the word 'force,' rather than 'induce,' because all arguments except those which can be supported by the pressure of the entrance examinations fail to awaken these schools to the needs of science-teachers in these higher institutions. The following remarks appeared in *Science* of May 18, 1883, and can be used appropriately in this connection: —

"In the brief, informal discussions [which took place at the Springfield meeting], the opinion was very generally expressed, that one of the most important questions with which we have to deal, and one which needs immediate attention, is the preparation necessary for the study of natural science in colleges. The great difficulty in making a success of college instruction in the sciences lies in the fact that not one young man in twenty knows either how to observe, or how to think about facts of observation. His education in that line is very deficient, or else entirely wanting; he is utterly helpless without his books, and seems quite unable to see or to correlate facts for himself. No other branch of the curriculum is so inefficiently treated by the preparatory schools and academies. It is the reverse of right that the college professor, with a class of from forty to eighty men, should have to make the vain attempt to teach the lowest step in the observational sciences. Methods which can alone guarantee success in imparting to the eye and the mind the rudiments of science cannot be employed under such conditions. Moreover, it is a matter for the deepest regret, that young men who are soon to be in places in the world where they have no books, and where the keenest exercise of the powers of observation, and the judgment of facts, are demanded, should in so many cases have no opportunity, or next to none, either in school or college, for the acquisition of a training upon which the success of their life-work, in the larger number of professions and occupations, is dependent.

"It is to be hoped that one needs only to mention such objects as these, to bespeak for this new association the sympathy and support of all naturalists, and earnest workers in science."

In the above remarks expression is given to opinions some of which, we know, will meet with general approbation, and others will very properly be regarded as merely personal views. We shall, however, have attained the object for which this address was written, if we have made it evident that this society can, if it be so disposed, take up questions of the highest importance to the public service of science, and help towards their solution by its deliberations. We believe it can do this wherever it can unite the majority of scientific men in opinion and in effort. The power which can be wielded by such an organization is in exact proportion, not to its numbers, but to its earnestness, determination, and especially its fearless support of what is just and right.

After referring further to the work of the society, as outlined in the article already referred to, Professor Hyatt proceeded: —

Enough papers to occupy nearly the whole time which can be devoted to them will be announced by the secretary. Though these and kindred subjects will be our most important objects, it was due to the society to show that its scope was not necessarily wholly confined to such details; and this we have endeavored to accomplish in the first part of the preceding remarks.

In conclusion, we beg leave to report that the executive committee has had great responsibilities thrust upon it since the first meeting. These they have endeavored to meet to the best of their ability; and we believe that the present attendance, and the many honorable names on our list, will help to extenuate the errors inseparable from haste and overwork.

In place of Professor Clarke, whose absence in Europe we regret, the executive committee appointed Dr. C. S. Minot, and he has faithfully and acceptably performed the duty of secretary *pro tem.*

THE NEW MORPHOLOGICAL ELEMENT OF THE BLOOD.

WITHIN recent years it has been established beyond doubt by the labors of Hayem, Bizzozero, and others, that there exists in the blood of mammals, and apparently of other vertebrates, a third type of corpuscle, differing morphologically from both the red and the white corpuscle, and possessing certain distinctive properties of the greatest importance in coagulation. These elements were called hematoblasts by Hayem upon the supposition that they are eventually transformed into red corpuscles. As this view is by no means established, it will be better to speak of them as blood-plates, the name given to them by Bizzozero. These blood-plates must not be confounded with the 'invisible corpuscles' of Norris. The latter, according to the testimony of most observers, are simply ordinary red corpuscles, from which the haemoglobin has been removed by the method of preparation. As might be supposed, the presence of these bodies was more or less clearly noticed by some of the many observers who for years past have made the blood a subject of investigation. That they escaped detection in the great majority of cases, is owing, doubtless, to the very rapid alterations which they undergo after the blood is shed, unless especial measures are taken to preserve them.

To Hayem belongs the credit of their real discovery. His investigation of their form, and, to a certain extent, of their properties, was so thorough, and his method of demonstrating their presence so simple, that the attention of other observers was forced to the subject; and his results were soon confirmed, with the exception of certain details of structure which are still open to investigation. On account of the quickness with which they are destroyed after the blood has escaped from the vessels, it is necessary to make use of certain preservative liquids which have the power of fixing these corpuscles in their normal shape. The solution recommended by Hayem is composed, of water 200 parts, sodium chloride 1 part, sodium sulphate 5 parts, and mercuric chloride .50 parts. Bizzozero recommends a .75% solution of sodium chloride, to which some methyl aniline violet has been added. Osmic-acid solution, 1%, may also be used. To obtain good specimens of the blood-

plates, the following method is suggested by Laker. A drop of preservative liquid is placed on the slide, and a drop of blood on the cover-slip, and the slip laid quickly on the slide, so that the two drops come in contact. As many as possible of the red corpuscles are then drained off by means of a piece of filter-paper applied to the slip on the side opposite to the drop of preservative liquid; or the two drops may be placed on the slide, and the cover-slip laid on from the side of the preservative liquid. The one precaution which it is necessary to observe is to lose as little time as possible in transferring the blood to the preservative liquid.

Obtained in this way, the blood-plates of the mammal are small, non-nucleated, discoid bodies from one-fourth to one-half the size of the red corpuscles. Hayem states that they are bi-concave, like the red corpuscles, and that many of them have a slight greenish or yellowish color due to the presence of haemoglobin. Bizzozero, on the other hand, maintains that they are perfectly colorless and not bi-concave. Mayet supports Hayem's statement with regard to the presence of haemoglobin in some, at least, of the blood-plates; while Laker thinks that the pale greenish hue possessed by them is owing to a reflection of light from the upper surface. The same tint may be observed in white corpuscles; and, furthermore, when the blood-plates are collected in masses, this color does not become more distinct. Laker confirms Hayem's statement that the plates are bi-concave, and says that he has often obtained from them the well-known optical phenomenon shown by the red corpuscles. The blood-plates occur in considerable numbers. According to Hayem, they are forty times more numerous than the white corpuscles, and twenty times less numerous than the red corpuscles. Staining-reagents have but little action upon them. Water causes most of them to disappear, though some individual plates may resist its action for a long time. Dilute solutions of acetic acid or caustic alkali quickly destroy them, while a 35 % solution of caustic potash is without any marked action. Laker states, that, in their general behavior towards reagents, they resemble most the nucleus of the white corpuscle. With regard to their origin, nothing is known. That they are not simply remnants of broken down white corpuscles is evident, in the first place, from the typical form they possess, and, in the second place, from the difference in chemical composition between the two, as shown by reagents. Bizzozero has proved conclusively that they are not pathological formations arising after the blood has been shed, since he has seen and studied them in the mesenteric blood-vessels of living animals.

Hayem believes that the blood-plates are finally transformed into red corpuscles. His reasons for this belief are as follows: 1. They possess a similar form; 2. They have a similar chemical composition, both containing haemoglobin; 3. The appearance of many intermediate forms between the typical blood-plate and the ordinary red corpuscle, especially in certain pathological conditions — after a severe hemorrhage, for instance. Under these conditions, Hayem states that the plates become more abundant, and gradually return to their normal proportion as the number of red corpuscles increases. In the main, these statements are confirmed by Mayet; but, as we have said, the similarity in form, and the presence of haemoglobin, are denied by others, especially Bizzozero; and neither Bizzozero nor Laker was able to detect any intermediate forms between the blood-plates and the red corpuscles. Perhaps the most interesting result that has come out of the study of these elements is the knowledge of the important part they take in the coagulation of blood. This property has been thoroughly investigated by Bizzozero. His conclusions may be briefly stated as follows. Liquids which have a tendency to prevent coagulation also preserve the blood-plates more or less completely from destruction. Experiments made upon blood kept within the living blood-vessel show that as long as the blood remains uncoagulated the blood-plates are unchanged, while the rapid coagulation of portions of the blood removed from the vessel is always preceded by a destruction of the plates and the formation from them of granular masses. When a drop of blood is whipped with small threads for about fifty seconds, the threads withdrawn, washed gently in .75 % sodium-chloride solution, and then examined under a microscope in the methylated soda solution, they are seen to be covered with a layer of plates, together with some white corpuscles. If the whipping is continued longer, the plates are converted into a granular mass, and covered with a layer of fibrine. If this process is reversed, and a slow stream of blood is allowed to pass over a thread watched under the microscope, the different stages of the process can be observed, — the deposition of the plates, their fusion into a granular mass, and the subsequent formation of fibrine. When one of these threads, to which the blood-plates and a few red and white corpuscles are adhering, is added to a liquid containing the two fibrine factors, but not fibrine ferment, coagulation takes place. That this coagulation is not owing to the thread or to the red corpuscles is easily demonstrated: it must result from the addition of either the white corpuscles or the blood-plates. When, however, bits of tissues rich in leucocytes — such as the spleen, lymph-glands, medulla of bone — are added to the above liquid, no coagulation at all, or else a very imperfect coagulation, follows. The inference, then, is, that the coagulation in the first case results from the addition of the blood-plates. In his latest communication, Bizzozero states, that if to a few drops of peptonized plasma, which coagulates very slowly, some water or carbon dioxide is added, and the preparation is examined under the microscope, the blood-plates will be seen collected into large heaps in which the individual blood-plates may still be recognized. In a few minutes the plates fuse together into a granular mass which becomes vacuolated, and at this moment coagulation begins. From the periphery of the granular heaps hundreds and thousands of fine processes radiate, and form a network which slowly spreads into the surrounding plasma.

Bizzozero attributes the origin of thrombi in blood-vessels to the destruction of these corpuscles. He has been able to watch the process of formation in the mesenteric vessels of living animals when a lesion of the walls of the vessels was produced in any way.

In the blood of animals with nucleated red corpuscles, Hayem has described a form of corpuscle which has properties analogous to those possessed by the blood-plates of mammals. These corpuscles may be preserved for study by the use of the liquids mentioned above. They are colorless, nucleated, slightly flattened bodies, bearing a general resemblance in shape to the red corpuscles, though usually more elongated at one or both of the poles. They vary greatly in size, but as a rule are somewhat larger than the white corpuscles. They are distinguished from the white corpuscles mainly by a difference in form and by the changes which they undergo after the blood has been shed. The white corpuscles are always more or less spherical, while the plates are flattened disks. After the blood has been shed, they become exceedingly viscous, and form granular masses from which fibrous processes radiate. Their functional value in coagulation appears to be the same as that of the blood-plates in mammals with non-nucleated red corpuscles.

WILLIAM H. HOWELL.

THE COMSTOCK LODE.

Geology of the Comstock lode and the Washoe district. By GEORGE F. BECKER. (Monographs U.S. geol. surv., iii., with an atlas.) Washington, 1882. 422 p. 4°.

THE appearance of the second of the new series of monographs published by the U. S. geological survey will be greeted with pleasure by the scientific world, not only on account of the amount of new information it contains regarding the geological and physical character of one of the most important ore-deposits on the globe, but also as an index of the increasing interest which is being taken in this country in a very important but comparatively new branch of geological research. Becker's report contains, with perhaps one exception, the most considerable contribution yet made by an American to microscopical petrography, and deserves for this reason, aside from its other merits, high commendation.

Referring, for a historical, economic, and technical treatment of the Comstock lode, to the works now in preparation by Messrs. Lord and Eckart, the author devotes himself to a purely scientific investigation of this interesting region. A *résumé* of the results reached by von Richthofen, Zirkel, King, and Church, is given, which is followed by a detailed description of the rocks in connection with which the ore-deposits occur. This work is carefully done, and, notwithstanding a very apparent lack of acquaintance with the literature and many important methods of modern petrography, is a valuable contribution to the subject. For instance: the actual presence of the suspected sodalite in the granite might easily have been placed beyond a doubt by a simple microchemical test. Again: the measurement of extinction-angles would have been much more satisfactory had they been made on cleavage pieces from their isolated powder instead of in the sections; while Boricky's test would certainly have yielded as good results as Szabo's.

The variety of rocks in the area studied is very great, comprising, in order of their ages, granite, metamorphics, granular diorite, porphyritic diorite, metamorphic diorite, quartz-porphyry, earlier diabase, later diabase, earlier hornblende andesite, augite andesite, later hornblende andesite, and basalt. None of these exhibit in their occurrence or structure any thing very striking or abnormal, if we except the sodalite in the granite, whose presence is, however, left very doubtful. Of especial interest are the decomposition processes, which have altered the rocks in the area between the Comstock and Occidental lodes almost past recognition. These are thought to be due to solfataric action, which was not earlier than the eruption of the later hornblende andesite; and they have received a good share of the author's attention. All the rocks of this area are equally decomposed; and, in the case of all, the same minerals have undergone the same alteration. Hornblende, augite, and mica change into chlorite, and this in turn generally to epidote, though sometimes to a mixture of quartz, calcite, and limonite. The felspar becomes filled with secondary fluid inclusions, and finally forms a mass of calcite, quartz, and a substance of unknown character, which, according to the author, is certainly not kaoline.

By far the most interesting results of the author's studies, from a petrographical standpoint, are those arrived at in reference to the origin and nature of that much-discussed rock-type, propylite. As is well known, this name was given by von Richthofen to certain early tertiary, andesitic rocks of Hungary, possessing a fibrous green hornblendic constituent and a granitic habit. Both von Richthofen and Zirkel regarded the Washoe district as a locality where this type was especially well developed; and the present author entered upon his work fully convinced of the correctness of their views. All the more interesting, then, is the fact that a careful and elaborate study of these

very rocks forced him to the opinion that propylite has no right whatever to be regarded as an independent rock-type, but is always an alteration product of diabase, diorite, or andesite, by the change of the bisilicates to uralite or chlorite.

In chapter iv. the author discusses theoretically the structural results of faulting. He regards the schistose structure, so often observed in the andesite, as the result of faulting under intense lateral pressure, and shows that such sheets would naturally tend to arrange themselves in a logarithmic curve, as seems to be the case at the Comstock.

The chapter on chemistry is not very satisfactory. But few new rock analyses are offered, and none are ably discussed in connection with the microscopic diagnosis. The finding of very small quantities of ore in the accompanying rocks, especially the diabase, would seem to suggest just the reverse course of reasoning from that adopted; and certainly none of the facts presented appear to warrant the supplanting of von Richthofen's theory, that the ores came from great depths, by one ascribing their deposit to segregation produced by ordinary solvents (hydrogen sulphide and carbon dioxide) from the rocks at the side of the lode.

The discussion of the heat-phenomena of the lode receives especial attention in chapter vii. The rapid increase of temperature is well known to be one of the great hinderances in working the mines, being nearly double the average observed elsewhere. This has been accounted for by some by chemical action: as, for instance, the oxidation of pyrite, or the kaolinization of felspar. The author concludes, however, in light of the careful experiments conducted by Dr. Barus in reference to the latter theory, that such an explanation is untenable; and that the source of the heat must be sought in former, and not entirely extinct, volcanic activity.

The observations of Dr. Barus, bearing on the electrical activity of ore-bodies, are recorded in chapter x. They relate as well to the deposits at Eureka as to those in the Comstock, and, while not directly productive of results of practical importance to the prospector or miner, possess a very considerable scientific interest.

The execution of the plates and maps is up to the usual high standard of the survey publications. The chromolithographic representations of rock-sections in polarized light are particularly successful, and, as far as my experience reaches, are the best of the kind yet produced anywhere.

MARTIN'S ELEMENTARY PHYSIOLOGY.

The human body: an elementary text-book of anatomy, physiology, and hygiene. By H. NEWELL MARTIN. New York, *Holt*, 1883. 11+355 p., 4 pl., illustr. 16°.

THIS volume forms the second volume in the 'American scientific series, Briefer course,' published by the Messrs. Holt. It is an abridgment of a larger work by the same author, and is intended for use in schools and academies. The demand for such a book, and the difficulty of preparing one, are well known to any one who has sought in vain, among the numerous text-books now in the market, for one really scientific, and suited to the age and needs of his pupils. It is a book of about three hundred and fifty pages, but how it could well have been made smaller we do not see. The language is simple, the style clear, and the book, at the same time, easily comprehensible and thoroughly scientific. It is elementary without being superficial. The essential facts are pointed out to the pupil without taxing his memory with a mass of unimportant details, or vexing him with conflicting theories on unsettled questions. At the end of each chapter these are condensed, and their connection shown in a brief summary, which aids the memory, and excites the interest of the pupil. From the physiological facts are deduced the most important laws of hygiene, while the student gains glimpses of wider fields of anatomy and zoölogy in the footnotes.

A new and most important characteristic of the work is the series of directions to teachers for demonstrating on frogs and rats the main outlines of anatomy, and for physiological experiments accompanying each chapter. These are all clearly explained, and easy, yet it is to be feared that they will be neglected by three-fourths of the teachers using the book. Their importance might well and justly have been far more strongly urged in the preface. We hear every year less of the objections to such dissections. The great difficulty is, that most of the teachers in our schools and academies have been taught physiology in the old way; and many of them have never even seen the inside of a frog. They greatly over-estimate the difficulties of such dissections and experiments, and do not appreciate that the sight of the real organ or process is worth more to the pupil than an hour's study of text-books or charts. If the teacher will once try fairly the experiment of following these directions, he will be surprised at the small amount of extra work caused, and at the enthusiasm

which they call forth in his class. The figures of the book are large and clear: in one or two of the plates so much has been attempted that they appear, at first sight, confused; but this is a slight blemish in a book worthy, in other respects, of all commendation. The book is well fitted, in the language of the author in his preface, to "prepare the student for the work of subsequent daily life by training the observing and reasoning faculties."

PACKARD'S BRIEFER ZOÖLOGY.

Zoölogy. By A. S. PACKARD, jun. New York, *Holt*, 1883. 5+334 p., illustr. 16°.

THE Zoölogy of the same series as the preceding is also an abridgment of and introductory to the larger text-book by the same author. Of the 315 pages of the text, only 130 are devoted to invertebrates: of the 180 pages devoted to vertebrates, many are occupied by large and very ornamental but hardly useful pictures. Of about 300 cuts, 90 are devoted to birds and mammals, and 40 to fish: of these a few are anatomical, the rest illustrations. The removal of many of these cuts would leave room for more print, without affecting the attractiveness of the book. The book is intended for young pupils, and yields to the common prejudice that birds and mammals are most interesting to this class. Yet precisely these animals come least within their reach, and their study of birds especially involves far more memorizing than observation on the part of most young pupils. These same pupils, in one afternoon excursion, could collect scores of insects, in which Professor Packard, as his other books show, could easily interest them. But to insects proper only 16 pages are devoted. Here a few pages of tables for determining the families, at least with one or two of the most common and familiar species as examples under each, would encourage the young student to new search and observation.

Of most of the lower types and classes the young student sees generally only one or two specimens, if any. Here clear, sharp, and exact definitions are needed to enable him to distinguish between essential and non-essential characters. These we miss; and here, as under certain types in the larger text-book, the student becomes bewildered in the attempt to burden his memory with a mass of, to him, equally important data. This is especially noticeable in the treatment of the difficult type of the Coelenterata, but more or less marked elsewhere. The points of affinity and difference between the succeeding types and the structural characteristics which form the basis of classification in the subdivision of those types are not clearly or sharply stated. There are no grand outlines to direct the student's attention. In a text-book intended exclusively for use in the laboratory, it is perhaps admissible that typical and specific characteristics should appear side by side, and with equal emphasis; in a text-book designed largely for use in the classroom as well, it is a great defect. These outlines are little, if any, clearer in the abridgment than in the larger book. The anatomical cuts are generally good, but they are most of them small, much smaller than those of the elk or moose; and in some of them so much has been attempted that the organs are sometimes difficult to trace. Larger and more schematic drawings would have been more useful. Barring certain of these defects, Professor Packard's larger work is the best text-book which we have for use in our higher schools and colleges, but it certainly has not been improved by abridgment.

MARIE'S HISTORY OF THE SCIENCES.

Histoire des sciences mathématiques et physiques. Par M. MAXIMILIEN MARIE. Tome I. De Thalès à Diophante. Paris, *Gauthier-Villars*, 1883. 286 p. 8°.

THIS volume is devoted to the mathematics of the Greeks, and covers nearly a thousand years (640 B.C. to 325 A.D.).

The author divides this time into three periods, roughly distinguished by the nature of the work done in geometry; the first period (640 B.C. to 310 B.C.) being that in which no attempt was made to apply arithmetic to geometry, but exclusive attention was given to dealing with and comparing concrete magnitudes without reference to their numerical measures. During the second period (310 B.C. to 150 B.C.), numerical measures of complex magnitudes began to be investigated,— for example, Archimedes obtained a first approximation for the ratio of the circumference of the circle to its diameter; but the numerical work was merely incidental, and was usually suggested by some problem connected with astronomy: while, in the third period (150 B.C. to 325 A.D.), reasoning on concrete magnitudes began to be largely replaced by reasoning on their measures, and geometry developed mainly in the direction of trigonometry.

At the beginning of the history of each of these periods is an introductory chapter con-

taining a brief résumé of the principal characteristics of the period, together with a short account of the progress made during the period in each of the branches of the mathematical science of the time, — geometry, arithmetic, physics, and astronomy. This is followed by the biographies of the mathematicians and physicists of the period and an analysis of their work.

The three introductory chapters, taken together, form a short and interesting history of Greek mathematics; while the biographies are sufficiently full, and the analyses are remarkably clear and concise.

SECONDARY BATTERIES.

The chemistry of the secondary batteries of Planté and Faure. By J. H. GLADSTONE and ALFRED TRIBE. London, *Macmillan & Co.*, 1883. (Nature series.) 11+59 p. 16°.

THE valuable papers of Gladstone and Tribe, originally printed in *Nature*, have been published in a collected form in the present volume, which contains much information as to the chemical actions going on in the Planté and Faure batteries. In successive chapters the authors consider the subjects of local action, the chemical changes occurring in the charge and discharge of the cell, the function of the sulphate of lead formed, and some minor topics. The chapter devoted to the function of the sulphate of lead, which the authors have shown to be formed in the normal action of the battery, is especially interesting. In the formation of a Faure cell, sulphate of lead, originally produced by local action, is oxidated to a peroxide on one plate, and reduced to spongy metallic lead on the other; and, when the cell is discharged, lead sulphate is finally produced on both plates. On recharging the battery, the authors consider that the lead sulphate is again oxidated on one plate, and reduced on the other, as when the cell was originally formed, — a point which is a very practical one, as the lead sulphate, if not oxidated, will soon prove fatal to the usefulness of the cell. This view, announced in the original papers, is substantiated by a number of recent experiments, notwithstanding the doubts that have been thrown upon it; so that, in charging and recharging, the plate of the cell is not corroded. It is also shown that the fact noticed by Planté, that elevation of temperature facilitates the formation of the cell, is explained by the more rapid formation of lead sulphate under these conditions.

RECENT PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Vassar brothers' institute, Poughkeepsie.

Dec. 5. — Professor W. B. Dwight gave the results of a recent re-examination by himself of Van Duzer's iron-mine, Cornwall station, Orange county, N.Y. Here a low ridge presents a red rock of sandstone and conglomerate, running into red shales to the south, in contact conformably with a highly fossiliferous limestone in nearly vertical layers. No other combination of the kind is apparent in this region, and there was much speculation among early geologists as to the horizon. W. B. Rogers called the red rock the triassico-jurassic sandstone; Dr. W. Horton considered it the Medina group, and assigned the limestone some place lower; Prof. Mather, with some doubt, concurred with Horton, and further assigned the limestone to the Catskill shaly limestone. Prof. Dwight, after a careful study of the locality, is satisfied that the red rocks are of the Medina epoch, and the limestones lower Helderberg; but by the fossils he identifies, in addition to the Catskill shaly limestone, the tentaculite limestone and the lower pentamerous groups. He finds no foundation for the statements of Horton, indorsed by Mather, that the iron ore occurs in layers between the layers of limestone. On the other hand, it is a bed of limonite formed at the base of the ridge superficially, as in other iron-mines of the region, by the decomposition of the red ferruginous shales at the junction with the limestone.

Five hundred and sixty-two specimens, representing various departments of natural history and archeology, were reported to the museum by the secretary.

Franklin institute, Philadelphia.

December 19. — A special committee, appointed to consider the propriety of recommending the councils of the city of Philadelphia to pass an ordinance requiring steam-engineers to pass an examination and to be provided with a license, as evidence of their competency, made majority and minority reports; the first taking the view that such action on the part of the society would be inexpedient, and the latter recommending such action. The reports were freely discussed, *pro* and *con;* and the subject was postponed for final action until the stated meeting in January.

Mr. G. Morgan Eldridge then read a paper on 'The British patent designs and trade-marks act of 1883 as affecting American inventors,' explaining the provisions of the new law to go into operation on the 1st

of January, 1884, and especially clearing up many points wherein the technical journals, which had favorably reviewed its provisions, had erred.

Prof. E. J. Houston introduced Mr. Patrick B. Delaney of New York, who thereupon described in detail his lately invented system of synchronous-multiplex telegraphy, illustrating the same with the aid of detail-drawings and lantern-slides of essential portions of his apparatus. Mr. Delaney's system, as thus far perfected, permits of the sending of seventy-two separate and distinct messages over a single wire simultaneously.

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Geological survey.

Geological field-work. — Mr. J. S. Diller, in his reconnaissance of the Cascade Range, passed through the Dalles, at the north end of the range, and followed it southward into California. The following is an abstract of the preliminary report made by him to Capt. C. E. Dutton, who has charge of the investigation of the volcanic rocks of that region. Andesites and basalts are found on the west side; and at Oregon City the lavas have a thickness of three hundred feet. The massive rocks stretch far southward towards Salem; and on them rest extensive alluvial deposits which form fertile plains in the valley of the Willamette, French's Prairie being one of them. Between Salem and Albany the eruptive rocks also occur; but at Jefferson, a short distance north of Albany, the miocene sandstone occurs, and is extensively used in the neighborhood for building-purposes. From Albany to Eugene City, both eruptive rocks and the miocene sandstones occur, the latter being well exposed at Springfield and before reaching the Calapooia Mountains. Thirty-five miles south of Eugene City the miocene sandstone is frequently penetrated by basaltic and other eruptive rocks. Near Cottage Grove the sandstone resembles somewhat a tufa, but contains coal, like the miocene north-east of Lebanon. Coal with a thickness of five feet is said to occur at the great bend of Pit River, but was not seen by Mr. Diller, as he did not visit the locality. The Calapooia Mountains are made up mainly of recent volcanic rocks, especially on the north side. Fragmental rocks are found on the south; but whether they are paleozoic, or not, remains in doubt. These beds extend to near Oakland, where well-marked tertiary appears. South of Rosebury is a belt two miles in width, of olivine enstatite rocks, altered, for the most part, into serpentine. It is bounded on the south by a highly tilted conglomerate, which resembles the millstone grit of the Alleghanies. No fossils were found in it, but on petrographical grounds it was referred to the cretaceous, which Mr. Diller says has not been recognized north of Rogue River valley, from which it is separated by a belt of crystalline stratified rocks, — the eastward continuation of the Rogue River Mountains. South of Myrtle Creek, schistose rocks occupy a belt along the southern branch of Umqua River to Cañonville, where crystalline schistose rocks form the prominent mountain ridge through which the gorge of Cañon Creek is cut. These rocks are penetrated by a granite which has probably been land-surface for a long time. This granite outcrops frequently in southern Oregon and northern California, especially in the Siskiyou Mountains, which are principally made up of it: it also forms Trinity Mountain and Castle Rock.

The crystalline rocks representing the eastern prolongation of the Rogue River Mountains are limited on the south by the supposed cretaceous rocks of Rogue River valley. Mr. Diller thinks that both cretaceous and tertiary rocks are embraced in the section seen on the north-east side of Stewart's Creek (a tributary of Rogue River extending eastward from Jacksonville). These rocks extend into California, where they are covered by the great flow of recent eruptive rocks in the plain north of Mount Shasta.

Little Shasta valley, especially between Shasta post-office and Mount Shasta, is an extensive plain covered by a flow of basic lava like that on the great plain east of the Cascade Range in central Oregon. Mount Shasta rises above a similar plain.

At the Haystacks, a short distance north of the base of Shasta, granite occurs. Between Mount Shasta and Lassens Peak, Cambrian, mesozoic, and tertiary occur. Around the eastern base of Shasta to Burney valley, and westward over the mountain crest to Buzzard Roost, little else is seen than basic volcanic rocks. Four miles west of Furnaceville the road leaves Cow Creek, and ascends to the 'plain,' which is covered with angular bowlders and thin soil underlaid by coarse conglomerate. From Buzzard's Roost a cañon along Cow Creek is cut in carboniferous limestone and other altered sedimentary rocks.

At Furnaceville, in the metamorphic rocks found west of the limestone, mining operations have been carried on; but at present the openings are deserted. Farther west, cretaceous (?) strata come in, dipping towards the Sacramento; and above them, tertiary rocks full of fossils. The latter extend to the alluvial plain of the Sacramento.

The Cascade Range, constituted almost wholly of basic lavas, is a low, broad arch, not less than seventy-five miles in diameter, rising from 3,300 feet at Summit Prairie, near Mount Hood, to 5,600 feet at Crater Lake. About the head of Deschutes River the general plain, which more or less gradually merges into the slope of the mountains, has a height of 4,700 feet. Throughout Oregon this plain lies about a thousand feet below the general crest of the range; and both are formed of lava sheets arising from fissure eruptions. There are numerous topographi-

cal elements on the broad arch produced by local extrusions, or subsequent erosion; lava having been poured from many craters that rise from eight hundred to eight thousand feet above the arch, forming an irregular series of ridges having here and there a radial arrangement. Some are on a line, as if from a common fissure; but, for the most part, they are irregular in distribution. The great peaks of the range are all remnants of old craters. The larger ones form the most prominent peaks of the system, and, although post-miocene in age, are older than many of the smaller ones, which are mainly cinder-cones, which retain their crater-form more or less perfectly. As a rule, also, the latter are basaltic, while the chief mass of the larger ones is andesitic.

While Pit River, and perhaps some of its prominent tributaries, as well as the Umqua and Rogue rivers, are examples of antecedent drainage, it is probable that the Klamath and Columbia rivers, with their tributaries, are, in part at least, consequent. However, the trip was too hasty to make completely trustworthy observations on this point.

—During July, August, and September, Dr. F. V. Hayden, with Dr. A. C. Peale as an assistant, made a geological reconnaissance along the line of the Northern Pacific railroad from Bismarck, Dakota, to Helena, Montana. Geological sections were made at various points, especially with reference to the line between the Fox Hills cretaceous and the Laramie group. Collections of fossil plants and shells were made at Sims, Gladstone, and Little Missouri, in Dakota, and at Glendive, Miles City, Billings, the Bull Mountains, Stillwater, Livingston, Bozeman, and other places, in Montana. The various coal-mines along the line of the road were visited and examined, as were also the borings for artesian wells at Bismarck, Dakota, and at Billings, Montana.

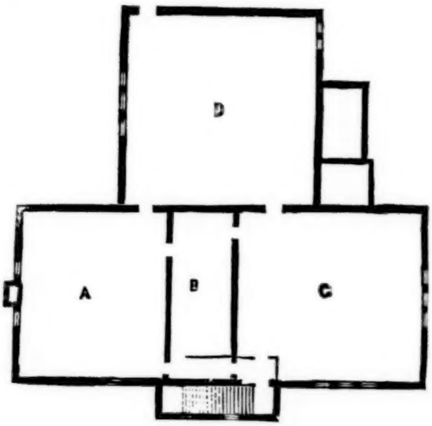
STATE INSTITUTIONS.

University of Kansas, Lawrence.

The new chemical laboratory.—The regents of the university have wisely provided for the increased growth and importance of the chemical department by the construction of a building for laboratory purposes. It is built of native limestone, with dressed stone and brick trimmings, and, as may be seen from the engraving, is in the form of a T.

The part extending east and west is 80 by 35 feet, and the L north of this is 40 feet square. The main laboratory and lecture-room are finished to the rafters, and all the rooms on the main floor are provided with additional light and abundant ventilation by sky-lights. The ground-floor rooms are 12 feet in the clear, and well lighted. These are occupied by an assay-room with crucible and muffle furnaces and complete apparatus for the fire assay of ores, and also by laboratories for blow-pipe work.

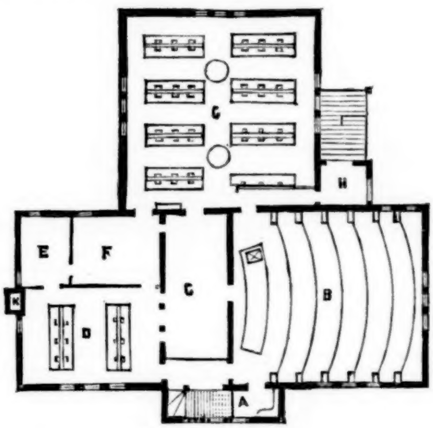
The east wing of the main floor, which is 14 feet to the eaves, is occupied by a lecture-room, seated in amphitheatre style, and capable of accommodating from 80 to 100 students. In addition to the ventilating apparatus above mentioned, the plan includes flues in the wall, connected with hoods, and hoods in the centre of the main laboratory, which are ventilated by glazed pipes terminating above the roof.



GROUND-FLOOR PLAN.

A, fire assay room; B, storeroom; C, metallurgical and blow-pipe laboratory; D, wet assay room.

All the rooms are supplied with running water, and gas, and heated by steam. The laboratory intended for qualitative students has over 25,000 cubic feet of air-space, and is intended for 54 students, each to be supplied with cupboards, sets of reagent bottles, etc. The tables are to be furnished with slate tops, and, in the quantitative room, with filter-pumps.



SECOND-FLOOR PLAN.

A, washroom; B, lecture-room; C, storeroom; D, specialists' laboratory; E, balance-room; F, professor's office; G, qualitative laboratory; H, porch; I, stairway.

Protection from fire is insured by means of a large tank in the attic, from which pipes supply the different rooms.

The building was erected at a cost of $12,000; and this sum, wisely and economically expended, leaves the chemical department as amply provided with facilities for instruction as any institution west of the Mississippi. E. H. S. BAILEY.

Lawrence, Kan.

NOTES AND NEWS.

Nature states that the Swedish frigate Vanadis has just started on a cruise round the world. King Oscar's second son participates in the cruise, as well as Dr. Hjalman Stolpe, who has been commissioned by the government to collect materials for the nucleus of a national ethnographical museum in Stockholm. The frigate, whose mission is chiefly scientific, will call at many places of interest, as, for instance, the Straits of Magellan, the Marquesas and Hawaiian Islands, the remarkable Malden Island, etc. A Swedish merchant, M. Fürstenberg of Gothenburg, has contributed six hundred pounds for the purchase of objects of scientific value.

— The Conseil municipal of Paris has granted a subsidy of 38,000 francs for the construction of a building in the Parc de Montsouris for the use and annual exhibitions of the Central society of apiculture and insectology. It is hoped to hold there the exhibition of 1885.

— M. Bourdalou having published in 1864, in his work 'Nivellement général de la France,' that the average level of the Mediterranean is by 0.72 metre lower than that of the Atlantic, this result was received with some distrust by geodesists. Gen. Tillo points out now, says *Nature*, that this conclusion is fully supported by the results of the most accurate levellings made in Germany, Austria, Switzerland, and Spain, which have been published this year. It appears from a careful comparison of the mareographs at Santander and Alicante by Gen. Ibanez, that the difference of levels at these two places reaches 0.66 metre, and the differences of level at Marseilles and Amsterdam appear to be 0.80 metre when compared through Alsace and Switzerland. The 'Comptes rendus de la commission permanente de l'association géodésique internationale' arrive at 0.757 metre from the comparison with the Prussian levellings; whilst the fifth volume of the 'Nivellements der trigonometrischen abtheilung der landesaufnahme' gives 0.809 *viâ* Alsace, and 0.832 *viâ*

NEW CHEMICAL LABORATORY OF THE UNIVERSITY OF KANSAS.

Switzerland. The difference of levels at Trieste and Amsterdam, measured *vià* Silesia and Bavaria, appears to be 0.59 metre. Each of these four results (0.72, 0.66, 0.80, and 0.59) having a probable error of 0.1 metre, their accordance is quite satisfactory; and we may admit thus that the average level of the Mediterranean is in fact lower by 0.7 metre than that of the Atlantic.

—Many years ago the late Mr. Leonard Horner communicated to the Royal society the results of a series of borings which he had caused to be made in the upper part of the delta of the Nile, with a view of ascertaining the antiquity of the civilization of Egypt. Since that time, Figari Bey, an Italian geologist in the service of the Egyptian government, has made and published the results of a large series of borings effected in different parts of the delta; but his work is hardly on a level with the requirements of modern science. It has been thought advisable, therefore, by the British government, to take advantage of the presence of its troops in Egypt in order to carry out a series of borings across the middle of the delta, in the full expectation that such borings, if made with proper care, and carried down to the solid rock, will afford information of the most important character, and will throw a new light upon the natural and civil history of this unique country. Instructions have been sent to the officer commanding the engineers to undertake the operations; and it is hoped, that, before long, information will reach us which will be of no less interest to the archeologist than to the geologist.

—The committee of the British association for the advancement of science, consisting of Profs. G. H. Darwin and J. C. Adams, for the harmonic analysis of tidal observations, made its report at the Southport meeting of the association last year (1883). Professor Darwin, who is the author of the report, states, that, although it is drawn up in a form probably differing widely from that which it would have had if Professor Adams had been the author, the latter agrees with the correctness of the methods pursued. The general scope of the paper is to form a manual for the reduction of tidal observations by the harmonic analysis inaugurated by Sir William Thomson, and carried out by the previous committee of the association; and it is intended to systematize the exposition of the theory of the harmonic analysis, to complete the methods of reduction, and to explain the whole process. The method of mathematical treatment differs considerably from that of Professor Thomson; he having followed in particular, and extended to the diurnal tides, Laplace's method of referring each tide to the motion of an *astre fictif* in the heavens, considering that these fictitious satellites are helpful in forming a clear conception of the equilibrium theory of tides. Professor Darwin, however, having found the fiction rather a hinderance than otherwise, has departed from this method, and connected each tide with an 'argument,' or an angle increasing uniformly with the time, and giving by its hourly increase the 'speed' of the tide. In the method of the *astres fictifs*, the 'speed' is the difference between the earth's angular velocity of rotation and the motion of the fictitious satellite amongst the stars. The committee practically found itself engaged in the question of the reduction of Indian tidal observations; since it is only in that country that any extensive system of observation, with systematic publication of results, exists. Professor Darwin has discussed the entire subject with Major A. W. Baird, R.E., the officer in charge, at Poona, of the tidal department of the survey of India; and their general agreement as to the modifications to be made in the notation of the old reports appears to insure a harmonious course of future procedure. Major Baird returned to India in the spring of 1883, and lately began revising all the published results, so as to bring them into the uniform system here recommended.

—The southern part of the peninsula of California has recently been explored by Dr. H. Ten Kate, who reports (*Rev. d'ethnogr.*, ii. 321–326) that there are no longer Indians of pure race dwelling in that region. The blood of the ancient Pericuis and Coras flows, it is true, in a great number of métis; but they resemble the Spaniard far more than they do the Indian. In the graves of the dead few relics are found. Here and there on the cliffs are rock-paintings, a few of which Dr. Ten Kate reproduces. The paper closes with the account of a discovery in Sonora. M. Emeric has found upon the shore of the sea, about ten metres above the water-mark, under innumerable blocks of lava, objects resembling fishes and turtles cut out of marble and a hard green rock. He also found several stone knives smoothly polished.

—The Society of naturalists of Moscow has sent Kudriaotzeff to examine in detail the geology of the region drained by the upper waters of the Oka. Dokuchaeff undertakes similar studies for the region traversed by the Volga. Both these investigations are made at the special request of the authorities of the provinces named; and their results, combined with those already derived from the studies of Russian geologists for other districts, will go far toward a basis for a satisfactory geological map of this part of Europe.

—The calculation by Gladisheff, of Stebnitzki's astronomical data for the position of Ka-uchit Kala, the capital of the Merv oasis, has been concluded, and places it in 37° 35′ 19″ north latitude, and 59° 27′ 20″ east longitude, from Paris, — a position tolerably near that derived from older and less perfect observations.

—Some interesting facts regarding the public collections of American archeology in the United States are given by Henry Phillips, jun., in a paper to the American philosophical society. Judging by this report, there are six museums of the first class in this country, containing upwards of five thousand specimens, — the Academy of natural sciences in Philadelphia, the Davenport academy of natural sciences, the National museum at Washington, the Peabody museum of American archeology and ethnology at Cambridge, the Peabody academy of science at Salem,

and the Wisconsin historical society at Madison. To these must doubtless be added the American museum of natural history at New York, and the Peabody museum at New Haven, from which he received no reports.

Four museums should apparently be grouped in a second class as important ones, but not so extensive as those of the first class; namely, Amherst college, the New London county historical society, the Wisconsin natural history society of Milwaukee, and the Wyoming historical and geological society at Wilkesbarre, Penn. Eleven other museums are reported to have collections of considerable interest. To judge from the statements given in this paper, the Peabody museum at Cambridge is the largest in the country.

A list of twenty-five other institutions believed to have collections, and from which no information was received, is appended. We have already referred to two. It may be remarked concerning these, that the Boston society of natural history has no such collections, and that there is no institution bearing the title 'Academy of natural sciences, Baltimore, Md.'

— Dr. George M. Beard and Mr. Herbert Spencer almost simultaneously sound the alarm against our modern worry in the words, 'The gospel of work must make way for the gospel of rest.' An English writer, signing himself E. S., protests, in the *Journal of science*, against a theory of civilization which makes the acquisition of material wealth almost its sole object, and which brands all men not engaged in such pursuit as idlers. "We have under its inspiration stripped our own country, over a great and increasing part of its surface, of every beautiful feature. We have blackened its skies with smoke-clouds, polluted its air with sulphurous acid, filled its streams with liquid filth, covered its hills with 'spoil-banks,' blighted its green fields, cut down its woods, and extirpated many of its most lovely animal and vegetable species. Our cities, from London downwards, present, as their main feature, meanness, monotony, and ugliness by the square mile; rarely, indeed, relieved by a street or a single building upon which the eye may rest without pain." The diseases caused by over-work, public morals, and the effect of our system on true intellectual progress, receive vigorous treatment. The author concludes that our industrial civilization is found wanting in every particular. "It has broken down more rapidly and more disastrously, even, than the military *régime* which preceded it, and will be found to have left upon the human race even deeper marks of its failure."

— About half way between the mouth of the Santa Cruz River and the base of the Andes, and situated along the left bank, Signor Moreno has discovered an eocene deposit rich in mammalian remains. It lies at the base of an elevated terrace some eight hundred and twenty-five feet in height, and is made up of alternate lacustrine and marine strata (eocene, miocene, and pliocene), whose summit is mantled by an extensive accumulation of glacial detritus. The most important find here was the skull of a huge mammalian named by Burmeister 'Astrapotherium patagonicum,' and by him supposed to be closely related to Brontotherium, but which Moreno (under the new name of Mesembriotherium Brocae) considers to be a generalized type of marsupial, probably aquatic in its habits, and having certain characters in the skull to ally it with the Carnivora. In the same deposit were found the remains of a true marsupial. At a somewhat newer horizon, Moreno found the skulls of two genera of small-sized mammalians, which form a direct transition between the rodents and toxodonts. No traces of either miocene or eocene edendates were detected. In a deposit apparently transitional between the cretaceous and eocene were found two molars, with part of the cranium, of an animal (Mesotherium Marshii) whose true position has not as yet been absolutely ascertained, but which appears to represent the most ancient South American mammalian thus far discovered. Contrary to the opinion of geologists before him, Moreno considers Patagonia as the region whence the mammalia (late tertiary and quaternary) of the more northern regions have been derived. Instead of there having been a late southward migration into Patagonia, it is contended that a northerly migration set in with the advent of the glacial period; of which last, it is further claimed, there is convincing evidence. Patagonia is believed to have been united with the Antarctic continent on the one hand, and with Australia on the other.

— One of the reasons which led to the construction of inductive coils of the large diameter, employed by Professor Rowland in his present work on the ohm, is the hope of using them in a determination of the ohm according to the method of Lorentz. Their large size will admit of the use of a revolving-disk of more than half a metre in diameter.

— *The auk*, a quarterly journal of ornithology, the continuation of the *Nuttall bulletin*, as the organ of the American ornithologists' union, begins with January, 1884, under the editorial supervision of Mr. Allen, with Dr. Elliott Coues, Mr. Robert Ridgway, Mr. William Brewster, and Mr. Montague Chamberlain as associate editors, and with Messrs. Estes & Lauriat as publishers, necessitating the same general character as heretofore the *Nuttall bulletin* has borne, but with increased size and enlarged facilities.

— The Saturday lectures under the auspices of the Anthropological society and the Biological society of Washington will be delivered this year, as heretofore, in the lecture-room of the U. S. national museum, Saturday afternoons, at half-past three o'clock, beginning Jan. 5. The series will include twelve or more lectures, and will be divided into courses of four lectures each. The programme for the first course is herewith presented. The lectures are free, and the public are invited to attend. Jan. 5, Mr. Grove K. Gilbert, Cliffs and terraces; Jan. 12, Professor Otis T. Mason, Child-life among savage and uncivilized peoples; Jan. 19, Professor Edward S. Morse, Social life among the Japanese; Jan. 26, Major J. W. Powell, Win-tun mythology.